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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2887**

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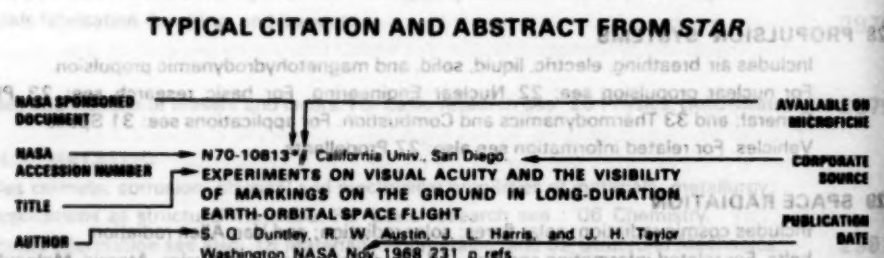
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AUTHOR
S. O. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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REPORT NUMBER
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space. Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-31070# Royal Aircraft Establishment, Farnborough (England).
TRANSONIC FLOW WITH HEAT INPUT. [SCHALLNAHE STROEMUNGEN MIT WAERMEZUFUHR]
J. Zierep Feb. 1970 14 p refs Transl. into ENGLISH from Acta Mechanica, no. 8, 1969 p 126–132
(RAE-Lib-Trans-1452) Avail: CFSTI

Basic equations for transonic flow around profiles, with heat input, are derived. A nonlinear differential equation of the mixed type with a source term for the heat input is obtained. An approximate solution of this equation is investigated for various values of the heat input. An important role is played by the phenomenon known as critical heat input. It is shown that heat input in the supersonic part of the flow field leads to a reduction of the drag. Author

N70-31101# National Aerospace Lab., Tokyo (Japan).
INTERACTION OF BLUNT BODIES IN SUPERSONIC FLOW
Takashi Tani, Iwao Kawamoto, Seizo Sakakibara, Junichi Noda, and Jiro Kondo 1970 34 p refs In JAPANESE; ENGLISH summary
Presented at 12th Intern. Congr. of Appl. Mech., Stanford, Calif., 31 Aug. 1968
(NAL-TR-190) Avail: CFSTI

The interaction of two blunt bodies placed in a uniform supersonic flow was investigated experimentally and analytically. From schlieren observation and surface pressure distribution measurement, it is found that the simple estimation given by Newtonian theory cannot be applicable to a strongly interacting flow field. When the interaction is so strong that the two bodies are covered with single convex shock wave, it is possible to apply an incompressible potential flow approximation. For moderate distance between two bodies, a nearly normal shock wave appears in front of the bodies. A simple estimation based on the continuity condition can be applied for this case. For the most interesting phenomena with partly concave shock wave, these approximations are not applicable, lemniscate coordinates are introduced, and Van Dyke's numerical computation is extended for this coordinate system. An example of the flow field around two bodies with partly concave shock wave is obtained. Author

N70-31502*# Pratt and Whitney Aircraft, East Hartford, Conn.
SINGLE-STAGE EVALUATION OF HIGHLY-LOADED HIGH-MACH-NUMBER COMPRESSOR STATES. 2: DATA AND PERFORMANCE, MULTIPLE-CIRCULAR-ARC ROTOR
D. H. Sulam, M. J. Keenan, and J. T. Flynn [1970] 101 p refs
(Contract NAS3-10482)
(NASA-CR-72694; PWA-3772) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 20D

Tests were conducted on a 0.5 hub/tip ratio single-stage compressor designed to produce a pressure ratio of 1.936 at an efficiency of 84.2 percent with a rotor-tip speed of 1600 feet per second and a flow rate of 187.1 pounds per second. Design pressure ratio was obtained at design speed with an efficiency of 84.5 percent and a flow of 181.3 pounds per second. For tests with radial inlet-flow distortion, the peak stage efficiency obtained at design speed was 78.4 at a pressure ratio of 1.774 and flow of 177.2 pounds per second. The peak stage efficiency with circumferentially-distorted inlet flow was 77.7 percent at a flow of 173.1 pounds per second and a pressure ratio of 1.747. Author

N70-31509# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
A PRESSURE-INTERACTION THEORY FOR AXISYMMETRIC, HYPERSONIC, LAMINAR, UNSEPARATED FLOWS. JANUARY 1969–JANUARY 1970
J. W. Ellinwood and R. L. Varwig 23 Jan. 1970 64 p refs
(Contract F04701-69-C-0066)
(AD-703713; TR-0066(5240-10)-10; SAMSO-TR-70-119) Avail: CFSTI CSCL 16/3

Theories for axisymmetric viscous interaction are extended to include arbitrary values of the ratios of both surface to free-stream pressure and boundary-layer to body thickness, by identification of a new measure of transverse curvature in the boundary layer. Methods for four limit flows are isolated. Two of the methods are existing solutions for cones with either a strong shock wave or very thin boundary layer. One is a new local solution for general, very thin bodies; it becomes exact when the pressure ratio approaches one or is unbounded. The fourth is a local similarity solution for power-law bodies with linearizable small-disturbance flow; it becomes exact when the ratio of boundary-layer to body thickness vanishes or is unbounded. These methods have provided interpolated estimates of pressure on a very slender cone-cylinder in hypersonic flow that compare well with original experimental data. Similar predictions of heat transfer rate compare poorly. Author (TAB)

N70-31520# Sandia Corp., Livermore, Calif. Aerothermodynamics Div.
HANDY: A COMPUTER PROGRAM FOR PREDICTING SUPERSONIC AERODYNAMIC CHARACTERISTICS OF SPHERE-CONE AND SPHERE-CONE-CYLINDER-FLARE AXISYMMETRIC BODIES AT SMALL ANGLES OF ATTACK
W. T. Ashurst Mar. 1970 24 p refs
(Contract AT(29-1)-789)

(SCL-DR-70-25) Avail: CFSTI

The HANDY computer program described in this report is a quick and easy method for estimating aerodynamic characteristics for re-entry bodies of sphere-cone and sphere-cone-cylinder shapes at angles of attack up to about 40 degrees. The program uses curve fits of sphere-cone, zero-attack-angle pressure distributions from Blick and Francis. The use of these curve fits is the main improvement over computer programs based on Newtonian theory. NSA

N70-31528# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE REACTING WAKE PROGRAM: USER'S GUIDE Final Technical Report
James T. Curtis Feb. 1970 26 p
(AD-703940; CAL-AF-2815-A-1) Avail: CFSTI CSCL 16/3

The program computes the species concentrations and electron density, and pressure, temperature, velocity, density and wake radii within a reacting turbulent wake of a hypervelocity sphere. Author (TAB)

N70-31632*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ACOUSTIC TESTS OF A FLEXIBLE SPACECRAFT MODEL
W. E. Noonan and J. R. Daiber Washington NASA Jun. 1970 111 p refs
(Contract NAS1-8838)
(NASA-CR-1618) Avail: CFSTI CSCL 01A

An acoustic test program was conducted with a 1/10 scale dynamic model of a representative spacecraft structure to investigate the effectiveness of producing vibration response over a wide frequency range. The acoustic test facility utilized four airstream modulators and a laminated fiberglass progressive wave tube. Model configuration and position were varied during testing. Accelerometers, strain gages and displacement probes were used to determine the response of the vehicle while microphones were used to measure the acoustic field external and internal to the model. Acoustic noise levels of 140 to 146 dB were produced in the progressive wave tube. Results of the program have shown that wide band vibration was produced with little dependence on model configuration and position within the progressive wave tube. Author

N70-31643*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM TO DETERMINE EQUILIBRIUM-AIR FLOW-FIELD DATA ABOUT A BLUNT BODY BY THE METHOD OF INTEGRAL RELATIONS
Frances W. Taylor Washington Jun. 1970 79 p refs
(NASA-TM-X-2041; L-7071) Avail: CFSTI CSCL 01A

A computer program was developed in support of the study of the inviscid adiabatic flow properties (pressure, temperature, density, velocities, and enthalpy) around a blunt body in equilibrium air by use of a modified method of integral relations. The digital computer program is described including the methods used in the digital approximation, flow charts, D1251 program code, instructions for the user, and a test case with input and output listings. Author

N70-31723# Ballistic Research Labs., Aberdeen Proving Ground, Md.
STRESS WAVE ANALYSIS IN A GENERALIZED LINEAR VISCOELASTIC MATERIAL USING FINITE DIFFERENCES AND CHARACTERISTICS
Stephen Gerard Sawyer Feb. 1970 44 p refs
(AD-702891; BRL-1472) Avail: CFSTI CSCL 19/7

An explicit finite difference scheme for solving the one-dimensional wave equation for a generalized linear viscoelastic solid has been derived. An accurate solution near the wave front is obtained by placing the nodal points of the finite difference grid along the characteristics of the wave equation. The viscoelastic properties of the solid are represented in terms of a generalized Voigt model. A Fortran 4 program based on this scheme has been used to calculate the response to a step pulse, a triangular pulse, and a pulse which varies like 1-COS CT. In all cases, the calculated results are free of spurious oscillations which occur in certain other methods of numerical calculation, notably the extended Ritz method. Author (TAB)

N70-31806*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF NOSE BLUNTNESS ON AERODYNAMIC CHARACTERISTICS OF CRUCIFORM-FINNED MISSILE CONFIGURATION AT MACH 1.50 TO 2.86
Lloyd S. Jernell Washington Jun. 1970 28 p refs
(NASA-TM-X-2031; L-7066) Avail: CFSTI CSCL 20D

An investigation was conducted to determine the effects of various magnitudes of spherical nose bluntness on model stability. The effectiveness of a forward-protruding nose spike in reducing the axial-force coefficient of a blunt-nose configuration was also investigated. Data were obtained at angles of attack up to about 22 deg at sideslip angles of approximately 0 deg and 4 deg and roll angles of 0 deg and 45 deg. The tests were conducted over a Mach number range of 1.50 to 2.86 at a Reynolds number of 2.5 x 1,000,000 per foot. Author

N70-31890*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
BUFFET AND STATIC AERODYNAMIC CHARACTERISTICS OF A SYSTEMATIC SERIES OF WINGS DETERMINED FROM A SUBSONIC WIND-TUNNEL STUDY
Edward J. Ray and Robert T. Taylor Washington Jun. 1970 266 p refs
(NASA-TN-D-5805; L-7011) Avail: CFSTI CSCL 01A

A wind-tunnel investigation has been conducted in the Langley high-speed 7- by 10-foot tunnel to determine the buffet and static aerodynamic characteristics of a systematic wing series at Mach numbers ranging from 0.23 to 0.94. The results have indicated that for a given Mach number the wings which display superior aerodynamic efficiency characteristics generally display the highest buffet-free lift coefficient. The characteristics exhibited by the wings which were considered have indicated that correlations can be made between the onset of buffeting and selected divergencies in the static aerodynamic characteristics. Axial force has been found to be the most sensitive static component to the onset of buffeting. Author

N70-31931# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
VORTEX THEORY OF A LIFTING SURFACE
N. N. Polyakov et al 18 Sep. 1969 20 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekh. i Astron. (Leningrad), v. 19, no. 4, 1968 p 121–131
(Contract NOw-62-0604-c)
(AD-703998; APL-CLB-3-T-808) Avail: CFSTI CSCL 1/3

The vortex theory developed for the case of a plate of rectangular planform is generalized to the case of arbitrary planform. The plate is considered as a number of elementary rectangular strips, each strip consisting of a number of horse-shoe vortices. The integral equation of the problem is given. Author (TAB)

N70-31970# Aeronautical Research Inst. of Sweden, Stockholm.
THE FLOW PERPENDICULAR TO FLAT PLATES
Erik Petersohn Apr. 1969 31 p refs
(FFA-117) Avail: CFSTI; Almqvist and Wiksell, Stockholm: Sw. Kr. 15

The flow perpendicular to a plane cascade and to a single plate is calculated by using the free boundary theory. The calculations are compared with experimental results. The flow in front of a circular plate is also investigated experimentally. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-30696*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
SIMULATOR STUDY OF THE INSTRUMENT LANDING APPROACH OF A HEAVY SUBSONIC JET TRANSPORT WITH AN EXTERNAL-FLOW JET-FLAP SYSTEM USED FOR ADDITIONAL LIFT
William D. Grantham, Perry L. Deal, and Robert W. Sommer Washington Jun. 1970 37 p refs
(NASA-TN-D-5862; L-7039) Avail: CFSTI CSCL 01C

The results indicated that no unusual piloting techniques were required to fly the landing approach on the simulated external-flow jet-flap airplane. However, a lateral-directional augmentation system was required and an autospeed control system was very beneficial. With the stability augmentation and autospeed control systems incorporated the average pilot rating assigned to the flying qualities of the simulated jet-flap configuration was 3 to 3-1/2. In addition, the results indicated that the use of spoilers or thrust modulation for direct lift control (DLC), in combination with autospeed control, was an effective system for tracking the glide slope, and both DLC systems were preferred over use of the elevator. Author

N70-30850*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
LABORATORY INVESTIGATION OF DIFFRACTION AND REFLECTION OF SONIC BOOMS BY BUILDINGS
J. D. Brooks, W. D. Beasley, and R. L. Barger Washington Jun. 1970 23 p refs
(NASA-TN-D-5830; L-7009) Avail: CFSTI CSCL 20A

A method is described for simulating the acoustic phenomena that occur when an N-wave passes over a building. Information concerning the enhanced overpressure in front of the building and the shielding effect of the building on the region behind it is obtained from comparative pressure measurements and from schlieren photographs of the shock pattern. The effects of varying parameters such as the shock-ground angle and the building size and shape are studied. Author

N70-31003*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
HAZARDS TO AIRCRAFT DURING APPROACH AND LANDING
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 2 May 1970 p 5–18 (See N70-31002 16-21)
Avail: CFSTI CSCL 01C

The meteorological conditions which affect visibility are discussed. Fog, rain, snow, and smog are considered in terms of both the degree to which they can impair visibility and the frequency of their occurrence. Accident statistics are presented and reviewed to determine their possible relationship to poor visibility. They are also studied in a broader sense to determine what system functions and what performance criteria are important in a hazard warning and avoidance system. Author

N70-31004*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
ECONOMIC BENEFIT OF IMPROVED LANDING CAPABILITY
In its Com. Air Transport Hazard Warning and Avoidance System Vol. 2 May 1970 p 19–30 (See N70-31002 16-12)
Avail: CFSTI CSCL 01C

The effect of poor visibility on airline operations is analyzed. Operationally, poor visibility leads to delays, diversions, and attendant cost penalties. The inclusion of equipment to provide added landing capability presents a potential way to avoid some of these penalties. The cost benefit of improved landing capability is evaluated and the basis is provided by which the cost of the additional equipment may be weighed against the cost benefit of added capability in the sense of economic justification. Emphasis is placed on evaluation of the saving associated with improvement in terms of visibility increments. The magnitude of the saving is related to airline operating procedures and to the unique visibility characteristics of individual airports. Author

N70-31009*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
AN ANALYTICAL TREATMENT OF DELAYS AND DELAY COSTS, APPENDIX A
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 2 May 1970 36 p (See N70-31002 16-21)
Avail: CFSTI CSCL 01C

In airline operations poor visibility results in delays, diversions, and cancellations, each of which results in an economic penalty. The method by which visibility data for an airport can be used to generate information regarding delays, diversions, and the cost associated with them is presented. The derivation begins with the development of equations for the delays and diversions due solely to bad weather. The equations are then extended to include the compounding of delay due to traffic accumulation during the bad weather. The entire derivation is structured to utilize visibility data in the form in the given climatological summaries. The tables list the number of occurrences during a ten-year period of visibilities at or below the listed levels. The tables further subdivide the data into time intervals of bad weather durations. Author

N70-31036# Denver Univ., Colo. Coll. of Engineering.
AUTOMATIC STABILIZATION FOR V/STOL AIRCRAFT IN THE VERTICAL FLIGHT MODE
Ralph Lee Buechler (M.S. Thesis) Dec. 1969 76 p refs
(AD-700900) Avail: CFSTI CSCL 1/3

Postulating a simple descriptive aircraft transfer function for non-aerodynamic, slow speed flight, a control method is presented for the automatic stabilization of large, lift-fan Vertical and Short Take-off and Landing (V/STOL) aircraft flying in the vertical flight mode. Dead-zone (bang-bang) control is employed, and the entire scheme is time optimal in the sense that the origin is obtained as fast as possible following exit from a dead-zone region and is fuel conservative in the sense that small deviations within this dead-zone are tolerated, causing no fuel to be burned. Although the method is not limited to any particular aircraft transfer function or disturbance shape, it is used to calculate the approximate reaction jet control power needed to control the momentum transfer to the aircraft created by a discrete gust under a maximum roll deflection criterion. Author (TAB)

N70-31326# Air Force Flight Test Center, Edwards AFB, Calif.
DEVELOPMENT OF A DATA ANALYSIS TECHNIQUE FOR DETERMINING THE LEVEL FLIGHT PERFORMANCE OF A HELICOPTER Final Report
John R. Somsel (M.S. Thesis—Arizona Univ.) Mar. 1970 58 p refs
(AD-703719; AFFTC-TD-70-123) Avail: CFSTI CSCL 1/3

The paper reviews and expands a helicopter level flight performance data analysis procedure. The data analysis procedure presents formulae to account for rotor blade compressibility and stall effects which until recently have been largely ignored in classical rotor analyses. The initial approach for determining a

helicopters level flight power required was through a power buildup concept. This concept was modified during the report to be more compatible with the flight test environment. Flight test data of the CH-3C helicopter was used for comparing and verifying the analytic determinations. Reasonable approximations to the CH-3C flight test data were attained, although an improvement in accuracy is needed before the method can be substantiated as a valid flight test procedure. The analytic approach utilized was considered to possess the potential for arriving at a solution and further studies in this area are strongly recommended. Author (TAB)

N70-31350# Naval Ship Research and Development Center, Washington, D.C. Dept. of Aerodynamics.
PARAMETRIC TRADE-OFF ANALYSIS FOR TILTING FREE PROPULSOR V/STOL AIRCRAFT IN EQUILIBRIUM TRANSITION
Robert J. Englar and Douglas G. Kirkpatrick Jul. 1970 98 p refs
(AD-703669; AERO-1158; NSRDC-3168) Avail: CFSTI CSCL 1/3

An analysis for tilting free propulsor Vertical/Short Take-Off and Landing (V/STOL) aircraft in equilibrium transition is presented. Families of curves are generated in terms of nondimensional flight parameters so that the effects of aerodynamic interactions and varying geometric configurations may be studied. For known values of the ideal hover quantities, the transition characteristics, including thrust and power requirements, may be determined for specific aircraft designs. Suggestions are presented as to those characteristics which should be incorporated into the design of a tilting free propulsor V/STOL aircraft. A comparison is then made between a tilt-wing and tilt-rotor aircraft, each employing the favorable characteristics prescribed by the tradeoff study. Author (TAB)

N70-31467# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ANALYTICAL STUDY OF AIR TRAFFIC CAPACITY IN THE NEW YORK METROPOLITAN AREA AND NEW YORK AIR TRAFFIC CAPACITY STUDY REAL TIME SIMULATION
Walter E. Faison, Milton B. Meisner, Paul H. Petersen, James J. Given, and Howard F. Slattery Feb. 1970 234 p refs
(AD-702779; NA-70-15) Avail: CFSTI CSCL 1/2

The report consists of two complementary studies directed to the determination of the air traffic capacity in the New York Metropolitan Area during the period from about 1972 to about 1980. The studies assume that two additional parallel runways and two short general aviation runways will have been added at John F. Kennedy International Airport and two additional parallels will have been added at Newark Airport. It also assumes that improvements in the air traffic control and navigation subsystems will have been implemented. The first study is an analytical and mathematical methodology to estimate capacity. The second study is a real time simulation study conducted on the air traffic control simulation system at the National Aviation Facilities Experimental Center. This study was conducted to provide a synthesis of several of the proposed methods for increasing capacity as well as verify capacity estimates made in the first study. Author (TAB)

N70-31577*# North American Rockwell Corp., Los Angeles, Calif.
XB-70 FLIGHT TEST DATA COMPARISONS WITH SIMULATION PREDICTIONS OF INLET UNSTART AND BUZZ
Arnold W. Martin and Warren D. Beaulieu Washington NASA Jun. 1970 33 p refs
(Contract NAS4-1175)
(NASA-CR-1631) Avail: CFSTI CSCL 01A

Comparisons have been made of XB-70 flight test data and simulation runs for three propulsion system transients. The three transients were: (1) a bypass-closing-induced inlet unstart at a flight Mach number of 2.34, (2) a throat-closing-induced inlet unstart at Mach 2.43, and (3) a throat-opening-induced inlet unstart at Mach 2.43. Simulation logic and computer programs were used for the simulation runs. The engines were simulated using the E-30 version of the General Electric Company's simulation program for the YJ-93 engine. With minor exceptions, the simulation results were in good agreement with the flight test data. Author

N70-31586# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
THE DYNAMICS OF SLENDER BEAMS: HELICOPTER ROTOR STUDY 1
Shieg-yu Lee Mar. 1970 14 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-702934; THEMIS-UI-18) Avail: CFSTI CSCL 1/3

The purpose of the study is to formulate a non-linear exact theory for large amplitude flap-wise vibration of helicopter rotors. Previous linear beam theories, employing the assumption of small displacement, are limited in their treatment of the rotor problem. Some nonlinear theories have been developed. But these investigations, in one way or another, suffer from questionable assumptions and the true nature of the dynamics of a slender beam is not clearly understood. Beam equations for large amplitude vibration are formulated to include axial forces, shear deformation and rotatory inertia effects. Author (TAB)

N70-31624*# National Aeronautics and Space Administration, Langley Reserach Center, Langley Station, Va.
HIGH-ALTITUDE FLIGHT TEST OF A 40-FOOT-DIAMETER (12.2-METER) RINGSAIL PARACHUTE AT A DEPLOYMENT MACH NUMBER OF 2.95
Clinton V. Eckstrom Washington Jun. 1970 51 p refs
(NASA-TN-D-5796; L-7002) Avail: CFSTI CSCL 01C

The 41-pound (18.6-kg) test parachute system was deployed from a 239.5-pound (108.6-kg) instrumented payload by means of a deployment mortar when the payload was at a Mach number of 2.95 and a free-stream dynamic pressure of 9.2 lb/sq ft. The parachute deployed properly with the canopy inflating to a near full open condition followed immediately by a partial collapse of the canopy and subsequent oscillations of the frontal area until the system had decelerated to a Mach number of about 1.5. The parachute then attained an inflated shape that provided full drag area. During the supersonic part of the test, the average axial-force coefficient varied from a minimum of about 0.24 at a Mach number of 2.7 to maximum of 0.54 at a Mach number of 1.1. During descent under subsonic conditions, the average effective drag coefficient was 0.62 and parachute-payload oscillation angles averaged about + or − 10 deg with excursions to + or − 20 deg. Author

N70-31627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VERTICAL TAKEOFF AND LANDING
V. F. Pavlenko 11 Feb. 1970 121 p refs Transl. into ENGLISH from the Russian
(AD-703882; FTD-MT-24-379-69) Avail: CFSTI CSCL 1/3

Contents: Certain characteristics of flights in nature; Helicopters and rotary wing aircraft; VTOL aircraft; VTOL aircraft power plants; Stabilization and control of VTOL; Transition conditions of flight of VTOL aircraft; Flight safety of VTOL aircraft; Effect of a gas jet on the takeoff-landing site; Anomalies of flight characteristics of VTOL. TAB

N70-31637# Naval Air Test Center, Patuxent River, Md. Naval Test Pilot School.
FIXED WING STABILITY AND CONTROL THEORY AND FLIGHT TEST TECHNIQUES Flight Test Manual
Stewart D. Langdon 1 Aug. 1969 680 p refs
(AD-703681; USNTPS-FTM-103) Avail: CFSTI HC $10.00/MF $0.65

Contents: Stalls; Spins; Longitudinal flying qualities; Lateral-directional flying qualities; Transonic-supersonic flying qualities; and Automatic flight control systems evaluations. TAB

N70-31681*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FULL-SCALE WIND-TUNNEL INVESTIGATION OF THE STATIC LONGITUDINAL AND LATERAL CHARACTERISTICS OF A LIGHT SINGLE-ENGINE LOW-WING AIRPLANE
James P. Shivers, Marvin P. Fink, and George M. Ware Washington Jun. 1970 63 p refs
(NASA-TN-D-5857; L-7121) Avail: CFSTI CSCL 01A

The airplane was a light single-engine low-wing monoplane. Tests were made for an angle-of-attack range of −4 deg to 22 deg and over a sideslip range from 15 deg to − 15 deg at thrust coefficients of approximately 0.03 and 0.23. Control effectiveness was determined for a full range of deflections on the aileron, elevator, rudder, and flap. Author

N70-31808*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF A VTOL FLIGHT-DIRECTOR CONCEPT DURING CONSTANT-SPEED INSTRUMENT APPROACHES
James R. Kelly, Frank R. Niessen, and Robert W. Sommer Washington Jun. 1970 21 p refs
(NASA-TN-D-5860; L-7112) Avail: CFSTI CSCL 01D

A control-display concept was evaluated during approaches at a constant speed of 45 knots along a straight-in 6 deg glide path to a 50-ft (15 m) altitude. The results indicate that the pilot can perform acceptable approaches on a consistent basis and uses relatively small control inputs. The flight-director indicator provides a good indication of the necessary control action but, at the same time, requires considerable attention by the pilot to assure himself that he is making the proper control inputs. Author

N70-31878# Army Board for Aviation Accident Research, Fort Rucker, Ala. Human Factors Section.
DISORIENTATION EXPERIENCES OF ARMY HELICOPTER PILOTS
Frank W. Ogden, Quitman W. Jones, and Harold R. Chappell 1969 15 p refs
(AD-704335; Rept-2-64) Avail: CFSTI CSCL 5/10

Spatial disorientation has been recognized for a long time as a hazard to aviation. Since the U. S. Army is the free worlds largest user of helicopters, this study was designed to investigate this problem in Army aviation. The purpose is to show the nature and magnitude of this problem, and to learn from helicopter accident experience where design improvements are needed. Author (TAB)

N70-31913*# Lockheed-Georgia Co., Marietta.
AN ANALYSIS OF FLIGHT TEST DATA ON THE C-141-A AIRCRAFT
J. H. Paterson, W. T. Blackerby, J. C. Schwanebeck, and W. F. Braddock Washington NASA Jun. 1970 169 p refs
(Contract NAS1-8366)
(NASA-CR-1558; ER-10158) Avail: CFSTI CSCL 01A

Existing flight test results obtained during testing of the C-141A were used to derive drag polars and minimum profile drag for a rigid airplane, with proper accounting for the effects of aeroelastic distortion on the wing induced and profile drags, and on the airplane trim drag. In addition, the effects of airplane center of gravity location and flight test instrumentation were investigated. An assessment of the inherent inaccuracies of flight measured thrust and other parameters such as weight, speed, and altitude was made and related to the resulting rigid drag. Scatter of the measured flight test data averages around 3.5 percent of cruise drag and compares with an estimated inaccuracy of 3.3 percent. An insight into the scale effect on profile drag, defined as skin friction plus form drag, for large subsonic aircraft is provided by the results. The profile drag is shown by the flight test data to vary according to classical skin friction laws throughout the Reynolds Number range from 25 million to 86 million. This implies that the C-141A level of distributed roughness is sufficiently small that a terminal value of skin friction is not sustained. Author

N70-31957# RAND Corp., Santa Monica, Calif.
COMPUTER AIDED ADVANCED DESIGN AND PERFORMANCE OF AIRBORNE VEHICLES
Jean R. Gebman Mar. 1970 29 p
(AD-704133; P-4313) Avail: CFSTI CSCL 1/3

The results of the pilot investigation of the feasibility of computer aided military operations research of airborne vehicles indicates that (1) present computer technology represents a vast, virtually untapped resource; (2) the airborne vehicle design and performance analysis problem can be effectively modularized down to the level of superposing basic building block analyses of fundamental hardware components; (3) a diverse spectrum of vehicle configurations can be effectively handled by a single generalized system of computer programs assembled into logical subsystems which are independent of the vehicle configuration; (4) the design and assemblage of such a generalized system requires a thorough understanding of the computer hardware, the software programming language being used, and indeed, the engineering aspects of structures, aerodynamics, propulsion and performance. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-30824*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIAGNOSTIC PROCEDURES FOR ANTENNA HYDRAULIC DRIVE SYSTEMS
G. C. Winston, R. B. Tatge (GE, Schenectady, N.Y.), and J. J. Lombardo Sep. 1969 37 p Submitted for publication
(NASA-TM-X-63943; X-525-69-389) Avail: CFSTI CSCL 13G

Maintenance of a high level of reliability of the hydraulic drive subsystems of large steerable antennas requires an agressively pursued, continuing program of monitoring, testing, and maintenance. The use of commonly supplied instrumentation such as temperatue and pressure gages and of physical inspections while important and necessary are insufficient for reliability levels required for space exploration. A diligently conducted program of periodic fluid sampling and analysis greatly improves overall system reliability but has serious limitations which prevent attainment of the reliability required. A study of more powerful methods involving the analysis of vibration signatures shows the feasibility of detecting developing malfunctions in their incipient stage. This would permit corrective action to be taken during noncritical periods and hopefully circumvent the great majority of failures. Work in this area has reached the point of beginning a thorough field evaluation and extension of the technique to the full subsystem. Author

N70-30828*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION AND PERFORMANCE OF THE ELECTRICAL SUBSYSTEM FOR A 2 TO 15 kWe BRAYTON POWER

SYSTEM
Pierre A. Thollot, Richard C. Bainbridge, and James Nestor [1970] 17 p refs Proposed for presentation at 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21–24 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52831) Avail: CFSTI CSCL 10B

The electrical subsystem includes the engine control system, the electrical control package, the dc power supply package, the inverters, and required instrumentation. This subsystem underwent extensive experimental evaluation both on an individual component basis and as part of the complete flight configured power system. Tests were performed under a variety of conditions including high and low ambient temperatures, vacuum and atmospheric pressures, steady state and transient operating modes, and at design as well as off-design conditions. The electrical subsystem is described, and performance characteristics of individual components and of the subsystem when mated to the complete Brayton power system are discussed. Author

N70-30847*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATION OF AN ISOTOPE BRAYTON POWER SYSTEM WITH A LIFE SUPPORT SYSTEM
James N. Deyo, John L. Klann, and Raymond S. Bilski [1970] 13 p refs Proposed for presentation at 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21–24 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52833) Avail: CFSTI CSCL 10B

An analytical study was conducted to determine the feasibility of using an isotope Brayton power system to supply both the electrical and thermal needs of an integrated life support system. Emphasis was placed on studying the steady-state and transient interaction that would result from thermal integration of the two systems. Results of the study show that thermal integration can be accomplished most flexibly by extracting heat in the Brayton power system's waste heat loop through the use of an auxiliary liquid-to-liquid heat exchanger. Thermal transient effects on both systems are within operating tolerances. However, to provide the life-support-system process heating temperature requirement will necessitate operating the power system compressor inlet temperature about 40 F above the existing design point of 80 F, thereby reducing the calculated power system conversion efficiency from 0.29 to 0.27. Hardware modifications to permit integration were examined and found to be minor. Both systems can be made electrically compatible by the addition of a frequency converter. Author

N70-31000# California Univ., Los Angeles. School of Engineering and Applied Science.
IONIC CONDUCTION IN BETA-ALUMINA Interim Technical Report, 8 Feb.–8 Aug. 1969
Limin Hsueh Dec. 1969 33 p refs
(Contract DA-44-009-AMC-1661(T))
(AD-702938; UCLA-69-68) Avail: CFSTI CSCL 10/3

The investigation was undertaken to determine ionic transport characteristics in beta-alumina and between beta-alumina and adjacent phases. Polycrystalline beta-alumina disks were used for emf measurements of sodium activity in sodium amalgams of concentration 0.52 to 4.0 atom percent at 30C. No detectable electronic conduction of beta-alumina was observed. The current behavior, upon imposing a constant voltage source across the beta-alumina, was measured and found to decrease with the square root of time. The formation of metallic sodium bridges or dendrites were observed to form across polycrystalline beta-alumina disks. This could lead to degradation of beta-alumina when used as an electrolyte or separator in electrochemical cells. Author (TAB)

N70-31113# National Bureau of Standards, Washington, D.C.
STANDARD CELLS: THEIR CONSTRUCTION, MAINTENANCE, AND CHARACTERISTICS
Walter J. Hamer *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 76–113 refs (See N70-31104 16-09)
Avail: SOD $4.50

The effects of temperature, pressure, electric current, light, shock, and vibration on standard cells are discussed. A history of the realization and maintenance of the unit of electromotive force is also included. A record of international comparisons of the unit of electromotive force is presented as well as information on the constancy of the National Reference Group of Standard Cells. Author

N70-31114# National Bureau of Standards, Boulder, Colo.
OIL BATHS FOR SATURATED STANDARD CELLS
Patrick H. Lowrie, Jr. *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 114–117 refs Reprinted (See N70-31104 16-09)
Avail: SOD $4.50

Limiting bath temperature variations to less than 0.002 C per day, a modified on-off control system helps achieve the inherent accuracies attributable to standard cells. Author

N70-31574*# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
THERMIONIC ENERGY CONVERSION SYSTEM DESIGN, PHASE 1 Technical Interim Report
J. G. De Steese Jun. 1970 4 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952781)
(NASA-CR-110499; MDC-G-1697) Avail: CFSTI CSCL 10A

Established are parametric performance and characteristics of three baseline generators in the power range 50 to 200 w sub e composed of Isomite converter arrays in conventional aeroshell structures. Generator design and material selection reflect current or credible near-term technology. A brief review of advanced concepts based on future technology is included to illustrate the long-term growth potential of the concept. Plutonia-fueled multicell generators in this power range achieve a fully system-integrated specific power of 4 w sub e/lb and overall conversion efficiencies in excess of 6.5%. High thermal power density heat sources (such as Cm-244 fuel forms) and near-future technology materials development would allow system specific power up to approximately 17 w sub e/lb and efficiencies approaching 10%. Author

N70-31619*# Eagle-Picher Co., Joplin, Mo. Electronics Div.
HEAT-STERILIZABLE, REMOTELY ACTIVATED BATTERY DEVELOPMENT PROGRAM Final Report
Jack N. Brill 11 Mar. 1970 115 p Prepared for JPL
(Contracts NAS7-100; JPL-952214)
(NASA-CR-110498) Avail: CFSTI CSCL 10/C

In the first of two phases a study was made of the effects of heat sterilization on all cell and battery components. In the second phase, three engineering model batteries were built from the components selected in the first phase. The batteries were sterilized and tested to demonstrate the validity of the design. Author

N70-31642*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT AND EVALUATION OF A HIGH-EFFICIENCY POWER INVERTER
Eugene L. Kelsey and H. Milton Holt Washington Jun. 1970 36 p refs
(NASA-TN-D-5881; L-6677) Avail: CFSTI CSCL 10B

After a brief review of state-of-the-art power conversion techniques, a design and design methods are presented to derive a high-efficiency solid-state inverter in the range of 2 to 5 kilowatts. Complementary transistor circuits are used in all logic. The resulting power matrix configuration is scrutinized for major failure modes. The resulting inverter matrix is further improved by the application

of special circuits that reduce the transient effects of the switching elements. A final evaluation is presented, and efficiency curves are plotted over a wide load range. Author

N70-31734*# Electro-Optical Systems, Inc., Pasadena, Calif.
RESEARCH AND DEVELOPMENT OF ELECTROFORMED ALUMINUM SOLAR CELL CONTACTS AND INTERCONNECTS Final Report
R. Wizenick 18 Jun. 1970 144 p Prepared for JPL
(Contracts NAS7-100; JPL-952485)
(NASA-CR-110502; EOS-4039) Avail: CFSTI CSCL 10A

The R&D effort to establish feasibility and demonstrate the fabrication of aluminum contacted electroplated silicon solar cells, and aluminum electroformed silicon solar cell interconnections is presented. The process parameters for fabricating the electroplated aluminum contacted silicon solar cells from N/P silicon diffused blanks were individually investigated. The parameters of masking, aluminum electroplating, and silicon monoxide antireflection (AR) coatings were integrated to produce aluminum contacted silicon solar cells. The study, analysis, and development to establish feasibility of electroformed aluminum solderless interconnection of silicon solar cells are presented. Tooling designs for aluminum electroplating individual silicon solar cells, four cell, and 25 cell matrices are also presented. Author

N70-31761*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A DESIGN STUDY OF A 350 kWe OUT-OF-CORE NUCLEAR THERMIONIC CONVERTER SYSTEM
Roland Breitwieser and Edward Lantz 1970 15 p refs Proposed for presentation at 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21 – 24 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52846) Avail: CFSTI CSCL 10A

Nuclear thermionic systems with the thermionic converters outside the reactor have been reexamined in the perspective of several recent technical advances: new high temperature, corrosion resistant, high strength alloys; high heat flux heat pipes; improved thermionic converters; and lightweight, vapor-cooled radiators. These have been combined to yield a new look to the out-of-core approach. A compact reactor results; insulators are eliminated by the use of heat pipes as electrically resistive elements; and weights are reduced by combining vapor-cooled radiators, structural supports, and current leads into vapor-cooled radiator modules. The overall design is also highly modular and thus provides high reliability and a reduction in development costs. Author

N70-31871*# Ion Physics Corp., Burlington, Mass.
SOLAR CELL COVER GLASS DEVELOPMENT Periodic Technical Progress Report, 1 May – 15 Nov. 1968
15 Nov. 1968 31 p
(Contract NAS5-10236)
(NASA-CR-110533; Rept-6) Avail: CFSTI CSCL 10A

During the program period of this report, development of solar cell integral coverslipping was pursued using RF and high vacuum ion beam sputtering techniques. Results obtained using RF sputtering remained inferior to those from the ion beam sputtering process and RF sputtering investigation was terminated. Contamination of material deposited using ion beam sputtering has been virtually eliminated and post-coverslipping cell performance now approaches theoretical prediction. Coverslip stress remains the primary problem to be overcome and continues to limit acceptable cell fused silica integral coverslip thickness to approximately 2 mils. Reduction of stress appears to be feasible only through replacement of fused silica by another coverslip material. A candidate replacement has been selected and will be investigated using the ion beam sputtering process. Author

N70-31901*# Texas Instruments, Inc., Attleboro, Mass. Metallurgical Materials Div.
HEAT STERILIZABLE AND IMPACT RESISTANT Ni-Cd BATTERY DEVELOPMENT, VOLUME 3 Final Report, Jan. 1969 – Jan. 1970
J. M. Gondusky Jan. 1970 131 p Prepared for JPL
(Contract NAS7-100; JPL-951972)
(NASA-CR-110505; TIT-5-MMD-19869) Avail: CFSTI CSCL 10C

Impact testing of cell configurations within the range of 1000g to 4800g and 0.8 to 2.0 msec is reported. The material presented includes: (1) The development of a high impact testing facility is described along with details of the mechanical design of testing equipment and instrumentation. (2) The determination of the mechanical properties of Ni-Cd electrodes is reported and includes results obtained under tensile, compression, and bearing loading. (3) The dynamic response of elements to impact loading was determined and the data presented includes both theoretical predictions and experimental determinations. (4) A summary of Ni-Cd cell performance under impact testing is presented including failure criteria, impact process analysis, and significant test results. D.L.G.

N70-31906*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REQUIREMENTS, DESIGN, AND PERFORMANCE OF A CONTROL SYSTEM FOR A BRAYTON POWER SYSTEM
Ronald L. Thomas, Raymond S. Bilski, and Robert A. Wolf 1970 18 p refs Proposed for presentation at AIAA 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21 – 24 Sep. 1970
(NASA-TM-X-52845) Avail: CFSTI CSCL 10A

A Brayton Space Power System for future manned space missions is developed. The requirements, design, and performance of a Brayton control system are discussed. The control system provides the controls and displays required for power system startup, shutdown, and steady-state operation. Also provided is automatic power system protection in the event of engine malfunctions. The control system is designed for a minimum 5-year continuous operation. To achieve this, special circuits and redundancy have been included in the control system to insure continued safe power system operation even in the event of any single component failure. The control system consists of a signal conditioner connected to a control panel by a transmission cable. The signal conditioner mounts on the power conversion system and the control panel is located in a remote control room. Author

N70-31940*# Exotech, Inc., Washington, D.C.
SOLAR CELL PERFORMANCE: MATHEMATICAL MODEL Final Report
M. J. Barrett, M. B. Hornstein, and R. H. Stroud 15 Jun. 1970 56 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952548)
(NASA-CR-110503, TRSR-70-12) Avail: CFSTI CSCL 10A

A computer program was prepared to calculate the electrical characteristics of silicon solar cells as a function of cell parameters and space environmental factors. The program, in Fortran 4, computes short-circuit current and the current and power at selected voltages to permit construction of a current-voltage curve characteristic of the solar cell. Environmental factors considered are illumination intensity and spectrum, cell temperature, and exposure to corpuscular radiation. Author

N70-31998*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
DESIGN DESCRIPTION AND PERFORMANCE TEST RESULTS FROM TWO IDENTICAL BRAYTON HEAT EXCHANGER UNITS
Gabriel N. Kaykaty 1970 12 p refs Proposed for presentation at AIAA 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas,

Nev., 21 - 24 Sep. 1970
(NASA-TM-X-52844) Avail: CFSTI CSCL 10A

Two identical Brayton-cycle heat exchangers, each consisting of a high performance recuperator, a heat-sink heat exchanger, and interconnecting ducting, have been tested in combination with a Brayton turbine, alternator, and compressor. One test installation comprised the gas loop of the Brayton engine; the other was a complete Brayton engine containing all the system components with the exception of the heat source and radiator which were simulated. The design of the unit is described, and the results of the tests are compared to the anticipated-off design performance. Author

N70-31999# General Electric Co., Philadelphia, Pa. Space Div.
PERFORMANCE OF A LARGE SCALE NONEQUILIBRIUM MHD GENERATOR WITH RARE GASES
B. Zauderer Feb. 1970 68 p refs
(Contract Nonr-3867(00))
(AD-703314; DOC-70SD4; ONR-TR-14) Avail: CFSTI CSCL 10/2

An experimental study was performed of the operating characteristics of a large linear, supersonic MHD generator. A shock tunnel was used to heat the test gases, which was primarily a 99 percent neon+1 percent xenon mixture, to stagnation pressures of 1 to 5 atmospheres, temperatures of about 3500K, and electron densities on the order of 10 to the 10th power /cc. The test time of 5 milliseconds, which was about 10 times the traversal time of the gas through the generator, was sufficient to produce quasi-steady state conditions in the channel. It was concluded that electrode conduction losses and shock wave formations were the two major factors limiting the efficiency of this generator. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-30621# Michigan State Univ., East Lansing. Dept. of Biophysics.
THE SOLID STATE ELECTRICAL PROPERTIES OF PROTEINS AND BIOLOGICAL SYSTEMS Technical Progress Report, 16 Feb. 1969 - 20 Feb. 1970
Barnett Rosenberg Feb. 1970 5 p refs
(Contract AT(11-1)-1714)
(COO-1714-4) Avail: CFSTI

A theory of quantum mechanical tunnelling from activated energy levels as the physical mechanism for the compensation law behavior was developed. It is found that biological semiconductors are of a mixed type with both electronic and protonic charge carriers. It is also found that at hydration states where the nuclei acid is in the disordered form, the dominant charge carriers are purely electronic. As hydration increases, there is a sharp transition from purely electronic to purely protonic charge carriers at the hydration levels where DNA undergoes a phase transition from the disordered to the ordered state. In the case of hemoglobin and cytochrome C there appears to be a linear relationship between the contribution of protonic conductivity to the total conductivity with the hydration state. Conductivity in the solid state of bimacromolecules is dependent solely on the effective dielectric constant regardless of the nature of the absorbent causing the change in the dielectric constant. J.M.C.

N70-30631# Brookhaven National Lab., Upton, N.Y.
INFLUENCE OF THE LATENCY FLUCTUATIONS AND THE QUANTAL PROCESS OF TRANSMITTER RELEASE ON THE END PLATE POTENTIALS AMPLITUDE DISTRIBUTION
Branko Soucek [1969] 17 p refs
(BNL-14393) Avail: CFSTI

Probability distribution functions of e.p.p. amplitudes, obtained from experimental data, show peaks at 1,2,3, etc., times the mean amplitude of the spontaneous miniature potentials. Number of data in peaks are distributed according to the Poisson law with the mean quantum content m. It is shown that the shape of the peaks is a function of the m.e.p.p. amplitude distribution P(A), m.e.p.p. pulse shape h(t), latency distribution alpha(t), and the mean quantum content m. The developed theory takes all of these functions into account. Through sequential use of equations, one takes into account influences of alpha(t), h(t), P(A) and m, respectively, and can describe different models for building e.p.p.'s from m.e.p.p.'s. The most complete model takes all functions into account and produces the distribution composed of asymmetrical peaks. Author

N70-30660# Biotechnology, Inc., Falls Church, Va.
HUMAN PERFORMANCE IN THE UNDERSEA ENVIRONMENT: AN ANNOTATED BIBLIOGRAPHY
Raymond E. Reilly Jan. 1970 91 p refs
(Contract N00014-70-C-0052)
(AD-702781) Avail: CFSTI CSCL 6/19

The report is an annotated bibliography of 149 references concerning human performance and physiology in the undersea and dry hyperbaric environment. Also included are lists of additional bibliographies and scientists engaged in undersea research. Author (TAB)

N70-30699*# Naval Aerospace Medical Inst., Pensacola, Fla.
FOURTH SYMPOSIUM ON THE ROLE OF THE VESTIBULAR ORGANS IN SPACE EXPLORATION
Washington NASA 1970 393 p refs Held at Pensacola, Fla., 24 - 26 Sep. 1968; Sponsored by NASA, the Comm. on Hearing, Bioacoustics, and Biomech., and NAS-NRC
(NASA-SP-187) Avail: SOD $4.50; CFSTI CSCL 06C

The etiology, symptomatology, and treatment of motion sickness are considered with respect to the vestibular organ and related neurological functions. The interrelationships of the vestibular nuclei, cerebellum, and reticular formation together with their direct and indirect reciprocal connections with the brainstem, cord, and cerebral cortex are discussed. For individual titles see N70-30700 through N70-30730.

N70-30700*# Uppsala Univ. (Sweden).
EXPERIMENTAL STUDIES OF THE ELICITING MECHANISM OF MOTION SICKNESS
Arne Stjoeberg *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 7 - 28 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

After an analysis of ship movements and calculation of the maximal acceleration values for a normal-sized passenger vessel on high seas, it is concluded that angular acceleration is unimportant in the elicitation of seasickness. The vertical up-and-down motions of a ship are the most important, and experimental motion sickness can easily be provoked in human beings and dogs exposed to vertical movements in rapid elevators or hoisting cranes. Deaf mutes with reactionless labyrinths and dogs after labyrinthectomy have no symptoms of motion sickness after exposure to these rapid elevator movements. Results of hydromechanical studies and experiments on labyrinth models and temporal bones show that, when a person is exposed to linearly accelerated horizontal and vertical movements or to the movements of a ship on a heavy sea, pressure variations with accompanying displacements and flows in both the perilymph and the endolymph must occur at every point in the contents of the labyrinth. It is assumed that the symptom complex of motion sickness arises from the two receptor systems of the labyrinth: the otoliths and the

ampullar cristae. The intermittent headache and some of the psychic symptoms accompanying motion sickness may be due to the intracranial pressure variations caused by the linear acceleration movements. Author

N70-30701*# Rochester Univ., N.Y.
EXPERIENCES WITH RESEARCH ON MOTION SICKNESS
George Richard Wendt *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 29-32 refs Sponsored in part by ONR and Rochester Univ. (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Studies of motion sickness are briefly described and include studies of the nature of susceptibility to motion sickness, of the effects of wave character on incidence of motion sickness, of other factors related to motion sickness, including preventive drugs, and of the effects of sickness on performance. Author

N70-30702*# Defense Research Establishment Toronto, Downsview (Ontario).
NEURAL MECHANISMS UNDERLYING THE SYMPTOMATOLOGY OF MOTION SICKNESS
K. E. Money and J. D. Wood *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 33-34 refs (See N70-30699 16-04)
(DRET-720) Avail: SOD $4.50; CFSTI CSCL 06S

A review of knowledge about the neural mechanisms of motion sickness is presented, and recent unpublished attempts to increase that knowledge are related. The participation of peripheral afferent nerves, peripheral efferent nerves, and central structures is described and the integrated action of these structures is discussed. The structures that are indispensable for the vomiting of motion sickness are the vestibular apparatus, the vestibular nerve, the vestibular nuclei, the uvula and nodulus of the cerebellum, the chemoceptive emetic trigger zone, the vomiting center, and the somatic peripheral nerves to the respiratory muscles and to the muscles of the abdominal wall. Author

N70-30703*# Naval Aerospace Medical Inst., Pensacola, Fla.
CONFLICTING SENSORY ORIENTATION CUES AS A FACTOR IN MOTION SICKNESS
Fred E. Guedry, Jr. *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 45-52 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Evidence is adduced to support the hypothesis that conflicting sensory data relating to spatial orientation from among visual, vestibular, and somatosensory systems can induce motion sickness in the absence of any strong, long, or periodic stimulus to the semicircular canals or otolith system. Author

N70-30704*# Naval Aerospace Medical Inst., Pensacola, Fla.
THE OTOLITH ORGANS AS A PRIMARY ETIOLOGICAL FACTOR IN MOTION SICKNESS: WITH A NOTE ON OFF-VERTICAL ROTATION
Ashton Graybiel and Earl F. Miller, II *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 53-66 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Among investigators who agree that the vestibular organs are essential in producing motion sickness, there is either uncertainty or disagreement as to the roles of the otolith organs and the semi-circular canals which, under natural living conditions, furnish different information in response to linear and angular accelerations. The shifting emphasis on the essentiality of the two organs is briefly traced, leaving in doubt the role of the otolith organs formerly regarded as essential in the causation of seasickness and airsickness. This doubt has arisen by the demonstration that nystagmus, easily evoked when the canals are stimulated by angular or Coriolis accelerations, also may be manifested when a person is exposed to rectilinear accelerations or to rotating linear acceleration vectors (RLAV) in the absence of angular or Coriolis accelerations. Some experimental findings on man are reviewed. In one series, it was demonstrated that, in highly susceptible subjects, motion sickness may be experienced when the RLAV is within 4 deg of the physical upright. In a second series of experiments, nystagmus was evoked in subjects regarded as possibly having residual otolith function, based on the ocular counterrolling test, but absent canalicular function, based on lack of response to high angular accelerations and to irrigation of the external canal with ice water. Author

N70-30705*# Naval Aerospace Medical Inst., Pensacola, Fla.
THE SEMICIRCULAR CANALS AS A PRIMARY ETIOLOGICAL FACTOR IN MOTION SICKNESS
Earl F. Miller, II and Ashton Graybiel *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 67-82 refs (See N70-30699 16-04)
(NASA-Order T-81633; NASA Order R-93)
Avail: SOD $4.50; CFSTI CSCL 06S

Data are presented which support the view that the semicircular canals can act as the essential factor for the production of motion sickness and the evocation of symptoms characteristic of this malady in the absence of motion. Quantitative grading of acute symptoms demonstrate that motion sickness can be evoked by stimuli which are at once adequately provocative and unique for the canals. The results are compared with those of two provocative tests that introduce Coriolis forces and with one that generates a rotating linear acceleration vector when human subjects are exposed in rotating devices. Wide interindividual differences but only slight intraindividual differences among the six provocative test conditions are revealed. The pattern of symptoms manifested by the group of 10 subjects at the test endpoint, moderate malaise, is also similar among these tests. The fact that typical symptoms of motion sickness were produced by bithermal irrigation as well as simple angular acceleration in several subjects representing a wide range of susceptibility adds to the evidence that the semicircular canals can act as the primary etiological factor in this malady. Author

N70-30706*# Toronto Univ. (Ontario).
SECONDARY ETIOLOGICAL FACTORS IN THE CAUSATION OF MOTION SICKNESS
Walter H. Johnson *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 83-88 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Although individual differences in sensitivity of the nonauditory labyrinth undoubtedly constitute the primary factor involved, extralabyrinthine influences constitute secondary etiologic factors of importance under certain circumstances. Vision, cerebral activity, olfaction, food, ambient air temperature, sexual differences, age, and chemical toxicity including alcohol, illness, and adaptation are discussed in relation to their influence on motion-sickness susceptibility. Author

N70-30707*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE SYMPTOMATOLOGY OF MOTION SICKNESS
Jack E. Steele *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 89-98 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

Motion sickness is defined as maladaptation to a dynamic environment. The major symptoms are caused by inadequate and inappropriate vascular and circulatory responses, resulting mainly from inadequate perception (integration and analysis of the pertinent

sensory data) of the dynamic environment and consequent misestimation of the nature and degree of the threat involved.
Author

N70-30708*# Louisiana State Univ., Shreveport. Medical School
USE OF DRUGS IN THE PREVENTION OF MOTION SICKNESS
Charles D. Wood *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 99–108 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06E

The most potent drugs for the prevention of motion sickness are those with central autonomic activity. Drugs which block parasympathetic or stimulate sympathetic activity are most effective. Drugs such as the phenothiazines, phenoxybenzamine, or meprobamate, which reduce sympathetic activity, appear to increase susceptibility to motion sickness. Scopolamine was the most effective single drug, and when combined with *d*-amphetamine, it was even more effective in prevention of motion sickness. The antihistamines appeared to be more suitable for use with exposure to mild forms of motion. In highly susceptible individuals, or during exposure to more intense motion, the combination of scopolamine with *d*-amphetamine was the most effective preparation tested.
Author

N70-30709*# Naval Aerospace Medical Inst., Pensacola, Fla.
PREVENTION OF MOTION SICKNESS IN THE SLOW ROTATION ROOM BY INCREMENTAL INCREASES IN STRENGTH OF STIMULUS
Ashton Graybiel *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 109–116 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

The accelerations were generated by motions of the subject's head out of the plane of the room's rotation. In the first experiment, control of the accelerations was maintained principally through regulation of the room's velocity. In the second, the adaptation was speeded up by control over head motions made by the subjects as well as over the room's velocity. The cardinal findings in the experiments have important theoretical and practical implications in adaptation to Coriolis accelerations, as well as in the prevention of motion sickness by natural means in a rotating spacecraft.
Author

N70-30710*# Dartmouth Coll., Hanover, N.H. Medical School.
A RESUME OF SESSIONS ON MOTION SICKNESS
Herbert L. Borison *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 117–120 (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06S

The neurological elements responsible for coordinating the vomiting sequence of motion sickness are reviewed and the input and output components of the emetic reflex are discussed. Questions are raised as to the nature of the reflex arc in the vomiting of motion sickness, the cause for the long onset of the effects of motion sickness, and the mechanism by which anti-motion-sickness drugs act.
Author

N70-30711*# Uppsala Univ. (Sweden).
THE FIRST-ORDER VESTIBULAR NEURON
Hans Engstroem *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 121–136 refs (See N70-30699 16-04)
(Contract F61052-68-C-0064)
Avail: SOD $4.50; CFSTI CSCL 06P

The vestibular part of the statoacoustic nerve contains both afferent and efferent fibers, the former being much more numerous than the latter. The afferent neurons have bipolar ganglion cells located in one single ganglion cell in the inner meatus. The ganglion cells belonging to the vestibular nerve are considerably larger than those of the spiral ganglion and they also differ slightly in structure. Several of the vestibular fibers are thicker than the cochlear fibers. The majority of the vestibular ganglion cells are surrounded by a multilayered myelin sheath. In this sheath some regions are found where the myelin is very regular, but in most areas the myelin is quite irregular with alternating regions of loose and semicompact myelin. The majority of the ganglion cells are myelinated, but a small percentage (2 to 5 percent) have only a single or a double layer of Schwann-cell cytoplasm. These cells differ considerably from the myelinated ones, not only in structure for they are also much smaller. The way they are related to the sensory cells is not yet known, nor is their function known. Similar unmyelinated cells are found in about 10 percent of the spiral ganglion of the cochlea, and it has not yet been possible to certify their sensory-cell relation in the cochlea either. The efferent fibers are rather thin compared with afferent ones. They have their ganglion cells in the brainstem. Their peripheral endings form a rich plexus in the vestibular epithelia where they form many en passant synapses with sensory cells, nerve calyces, and nerve fibers. The vestibular nerve contains a large number of unmyelinated fibers found intermingled with the afferent and efferent nerve fibers.
Author

N70-30712*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTER ANALYSIS OF SINGLE-UNIT DISCHARGES IN THE VESTIBULAR NERVE OF THE FROG
Jorge Huertas and Ruth S. Carpenter *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 137–144 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The applicability of computer codes to the study of vestibular units during spontaneous and provoked activity is discussed. A computer window technique that analyzes the frequency, the shortest interval, the longest interval, and standard deviation is described. This technique seems to be particularly suited to describe the changes in activity of vestibular neurons. The results are discussed in light of present knowledge of neurophysiology and anatomy.
Author

N70-30713*# Rockefeller Univ., New York.
VESTIBULAR AND SOMATIC INPUTS TO CELLS OF THE LATERAL AND MEDIAL VESTIBULAR NUCLEI OF THE CAT
Victor J. Wilson *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 145–158 refs (See N70-30699 16-04)
(Grant PHS-5R01-NB-02619)
Avail: SOD $4.50; CFSTI CSCL 06C

An important input to Deiters' cells is that from the labyrinth, which includes fibers from static receptors. The input from the labyrinth is seen in a larger fraction of the cells projecting to the cervical and thoracic cord than of the cells projecting to the lumbosacral cord. Both groups of cells can be facilitated by impulses ascending the spinal cord. These impulses are due to activity in a variety of peripheral nerves coming from different receptors, but apparently not from primary spindle endings or Golgi tendon organs. The cells of Deiters' nucleus, that influence the excitability of motoneurons at all levels of the spinal cord via the vestibulospinal tract, are therefore themselves impinged upon by a variety of inputs that share in the regulation of their excitability. Some cells in the medial vestibular nucleus project to the spinal cord, but many more project rostrally. Both types of projecting cells are almost completely absent from the caudal region of the nucleus, as is the monosynaptic input from primary vestibular fibers. The vestibular input originates in the horizontal canal and utricle, and probably in other parts of the labyrinth. Electric stimulation of the labyrinth activates many projecting cells as well as many cells

without long axons. There is also a somatic input to cells in the medial nucleus, and it is of particular interest that vestibular and somatic inputs, as well as commissural inputs and inputs from fibers descending from higher levels of the central nervous system, converge on many cells lacking long axons projecting rostrally or to the spinal cord. It is probable that among these cells there are interneurons that regulate the activity of projecting cells. Author

N70-30714*# Birmingham Univ. (England).
ELECTROPHYSIOLOGICAL EXPERIMENTS ON THE ISOLATED SURVIVING LABYRINTH OF ELASMOBRANCH FISH TO ANALYZE THE RESPONSES TO LINEAR ACCELERATIONS
Otto E. Lowenstein *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 159–186 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The classical assumption that semicircular canals respond exclusively to angular acceleration and cannot be involved in the elicitation of responses to linear acceleration has recently been challenged by a number of observations. Experiments are described in which the isolated surviving labyrinth of elasmobranch fishes (dogfish and ray) was subjected to linear acceleration. Recordings from horizontal and vertical canals as well as from the utriculus and lagena indicate that semicircular canals under these physiological conditions (interruption of blood supply and opening into the perilymphatic space) do yield responses to tilting and to rotating vectors of linear acceleration which resemble those obtained from the otolith organs. As compared with the latter, however, the responses from the semicircular canal have a significantly higher threshold. Author

N70-30715*# Oslo Univ. (Norway).
ANATOMICAL ASPECTS ON THE FUNCTIONAL ORGANIZATION OF THE VESTIBULOSPINAL PROJECTION, WITH SPECIAL REFERENCE TO THE SITES OF TERMINATION
Rolf Nyberg-Hansen *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 167–182 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The spinal projection from the vestibular nuclei can be separated into two different fiber systems: the classical vestibulospinal tract and the fibers descending in the medial longitudinal fasciculus. Because of their origin from the medial vestibular nucleus and their medial course in the brainstem and the spinal cord, the latter are called the medial vestibulospinal tract, and the more laterally coursing classical vestibulospinal fibers are called the lateral vestibulospinal tract. The lateral tract comes from the lateral vestibular nucleus and descends in the ventrolateral funiculus organized in a somatotopical manner throughout the whole cord. The fibers terminate ipsilaterally in the entire lamina VIII and the neighboring parts of lamina VII of the spinal gray matter. No terminations are found among the perikarya of the motoneurons in lamina IX. The medial tract descends bilaterally in the dorsomedial part of the ventral funiculus to the rostral half of the cord only. There is no evidence of a somatotopical organization within this tract. The fibers terminate bilaterally in the dorsal half of lamina VIII and the adjacent part of Lamina VII. The fibers on the ipsilateral side outnumber those on the contralateral side. The medial vestibulospinal tract is concerned with movements of the head and neck and, according to recent physiological observations, also with presynaptic inhibition of primary afferents in the spinal cord. Author

N70-30716*# Tokyo Univ. (Japan).
THE CEREBELLOVESTIBULAR INTERACTION IN THE CAT'S VESTIBULAR NUCLEI NEURONS
Masao Ito *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 183–200 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

Postsynaptic effects of the vestibular and cerebellar impulses were investigated in the cat's vestibular nuclei neurons with intercellular recording techniques. These neurons were identified by their antidromic invasion from the spinal cord or the cerebellum and/or by their location determined with histologically controlled micromanipulation. The vestibular nerve impulses exert monosynaptically an excitatory effect upon many vestibular nuclei neurons, producing the excitatory postsynaptic potentials. Polysynaptic actions, however, involve both excitation and inhibition. In contrast, the cerebellar impulses along Purkinje axons evoke the inhibitory postsynaptic potentials monosynaptically in any of their target neurons. These vestibular and cerebellar impulses converge upon vestibular nuclei neurons in the fashion that the cerebellum is superposed on the reflex arcs which primarily formed between the vestibular nerve and certain vestibular nuclei cells. On the basis of these observations, an attempt is made to interpret the role of the cerebellum in terms of basic concepts of the control theory.

N70-30717*# Toronto Univ. (Ontario).
MULTISENSORY INFLUENCE UPON SINGLE UNITS IN THE VESTIBULAR NUCLEUS
John M. Fredrickson and Dietrich Schwarz *In* Naval Aerospace Med. Inst. 4th Symp. on theRole of the Vestibular Organs in Space Exploration 1970 p 201–208 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

Cells in the vestibular nucleus responsive to vestibular end-organ and joint simulation were studied by the method of single-unit analysis in the unanesthetized cat. Ninety-nine percent of the units responded to vestibular stimulation and 80 percent to joint movement. There were no responses to muscle pressure, or to optic or acoustic stimuli. The convergent pattern of the two effective sensory systems on single cells was usually summative. Cerebellectomy did not grossly alter the pattern of joint influence. The vestibular cells responsive to joint movement function to detect the angular positions of joints, and through discharge patterns indicate the rate and direction of movement, as well as the steady position of joints. The convergence of the two main position-sense receptors (joints and labyrinth) in the vestibular nucleus is discussed from the standpoint of its significance for rapid, reflex, postural adjustments, and postural stability. Author

N70-30718*# Pisa Univ. (Italy).
INTERACTION BETWEEN VESTIBULAR AND NONVESTIBULAR SENSORY INPUTS
Ottavio Pompeiano *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 209–236 refs (See N70-30699 16-04)
(Grant PHS-NB-05695-03)
Avail: SOD $4.50; CFSTI CSCL 06C

During the deep phase of sleep the activity of the second-order vestibular neurons increases phasically due to extralabyrinthine inputs to the vestibular nuclei. This activity leads to sudden contractions of somatic and extrinsic eye muscles (rapid eye movements, or REM sleep). Experiments were performed to find out whether the increase in the vestibular discharge is also able to effect transmission of somatosensory volleys through the ascending lemniscal pathway. The orthodromic lemniscal response recorded from the contralateral medial lemniscus on single-shock stimulation of the forelimb nerves is phasically depressed during the bursts of REM. This effect is still present after interruption of the spinocervical (Morin's) pathway, thus indicating that somatic afferent transmission through the cuneate nucleus is phasically depressed at this time. The synaptic mechanisms responsible for this effect were investigated. In particular, the antidromic group II cutaneous and group I muscular volleys led, respectively, from the superficial and the deep radial nerves on single-shock stimulation of the cuneate nucleus

are phasically enhanced during the bursts of REM. This increased excitability of the central endings of the cuneate tract fibers is taken to indicate presynaptic depolarization of the terminals of the primary afferents within the cuneate nucleus, thus leading to presynaptic inhibition of synaptic transmission through the cuneate nucleus. Author

N70-30719*# Naval Aerospace Medical Inst. Pensacola, Fla.
VESTIBULAR ACTIVITY IN THE DESCENDING MEDIAL LONGITUDINAL FASCICULUS
Bo E. Gernandt *In its* 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 237-242 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06C

The functional importance of the medial longitudinal fasciculus (MLF) in carrying vestibular impulses into the spinal cord was studied in cats. The amplitude, duration, and latency of the gross motor responses evoked by vestibular stimulation and recorded from cervical and lumbar levels do not show any significant or persistent changes after a selective bilateral disconnection of the descending MLF. Thus, in evaluating the hierarchical importance of the three descending vestibulofugal pathways, it becomes obvious that the MLF offers a much weaker link than the connections represented by the vestibulospinal and reticulospinal tracts. By sectioning all pathways other than the MLF in the brainstem at the cerebellopontine angle, this tract can be investigated in anatomical isolation from adjacent vestibular connections. Vestibular stimulation applied to this MLF animal preparation evokes motor responses which could be recorded as far down as midthoracic levels. No sign of activity was recorded from lumbosacral levels. Single MLF axon recordings demonstrate that the discharge frequency in response to vestibular stimulation may reach values that are more than twice the value of ventral-root alpha-fiber discharge in response to identical stimulation, and that the synaptic transmission across the vestibular nuclei occurs with a considerable safety factor. Author

N70-30720*# Rochester Univ., N.Y.
EVOKED POTENTIAL AND MICROELECTRICAL ANALYSIS OF SENSORY ACTIVITY WITHIN THE CEREBELLUM
Ray S. Snider and Karl Lowy *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 243-258 refs (See N70-30699 16-04)
(Grants NIH NB-04592; NIH NB-06827)
Avail: SOD $4.50; CFSTI CSCL 06C

The extensive to-and-fro connections between the cerebellum and the vestibular system were reviewed. Purkinje-cell inhibition to the vestibular system is recognized in the direct pathways, and the role of the crossed fastigiovestibular pathway is discussed. There is no overlap of auditory and vestibular areas in the cerebellar cortex, but there may be in the nuclei fastigii. In the cerebellocerebral projections, there is overlap at the cerebral levels. Microelectrode studies on the auditory area indicate that it has electrophysiological properties similar to those reported for other cerebellar areas. The functions of the cerebellum in the habituation of nystagmus is discussed and some electrophysiological interpretations given. Author

N70-30721*# Temple Univ., Philadelphia, Pa. Medical School.
CORTICAL PROJECTION OF LABYRINTHINE IMPULSES: STUDY OF AVERAGED EVOKED RESPONSES
E. A. Spiegel, E. G. Szekely, H. Moffet, and J. Egyed *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 259-268 refs (See N70-30699 16-04)
(Grant NIH-US-PHS-04418)
Avail: SOD $4.50; CFSTI CSCL 06C

While the observation of the eyeballs, the reactions of the trunk, and the extremities permits only a study of the vestibulo-ocular and the vestibulospinal reflex arcs, the perrotatory or postrotatory recording of the electroencephalogram or electrocorticogram may help one to ascertain the conduction of labyrinthine impulses and their projection to the cerebral cortex. The cortical responses to single rotations were summed by a Mnemotron computer. After cessation of rotation, long-latency, slow, sometimes multiphasic responses appeared in human subjects and in cats. In man they were either diffuse or were noted chiefly or exclusively in the region of the area preoccipitalis and/or parastriata. They are probably due to excitation of the diffuse thalamic projection system. Short-latency responses in the cat's cerebral cortex at the start of rotation were not limited to the second somatic sensory area, but were found also in parts of the auditory cortex and in the so-called association cortex; in some experiments they were also close to, or in parts of, the second visual area. The initial as well as the postrotatory reactions in posterior parts of the cerebral cortex were not prevented by bilateral ablation of the second sensory area; they depended on a functioning labyrinth. Author

N70-30722*# Uppsala Univ. (Sweden).
EXPERIMENTAL AND CLINICAL EXPERIENCES AND COMMENTS ON ULTRASONIC TREATMENT OF MENIERE'S DISEASE
Arne Sjoeberg *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 269-284 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06E

Almost 300 patients with Ménière's disease have undergone ultrasonic treatment and about 200 additional patients were not treated. The patients comprise a select series of severely disabled persons in whom no form of medical therapy had been effective. The mean duration of the disease was 8 years, but a number of patients had been afflicted for up to 20 years. The patients are carefully examined before, during, and after irradiation. The tests include nystagmography after caloric stimulation with water at 30 to 44 C, ice water, and audiometry. A clinical followup investigation of 228 consecutive patients revealed the following: freedom from or considerable improvement in vertigo was found in 89 percent; tinnitus had diminished or disappeared in 48 percent; hearing was improved or unchanged in 64 percent; and caloric reaction was clearly reduced in 58 percent. Of the last 200 surgical patients, only one has transitory facial paralysis. Author

N70-30723*# Illinois Univ., Urbana.
PATTERNS OF COCHLEAR HAIR-CELL LOSS IN GUINEA PIGS AFTER INTENSE STIMULATION BY SINUSOIDAL SOUND
Harlow W. Ades, Charles W. Stockwell, Lynn B. Poche, and Hans Engstroem (Uppsala Univ.) *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 285-298 refs (See N70-30699 16-04)
(Grant NGL-14-005-074)
Avail: SOD $4.50; CFSTI CSCL 06C

Guinea pigs were individually exposed to intense sinusoidal sound stimulation of various frequencies and varying also in intensity and duration. After a suitable period to allow for degeneration of damaged hair cells, the animals were sacrificed and surface preparations of the organs of Corti were made according to the method of Engström. Cochleograms of each organ of Corti were constructed to map the position and condition of each cochlear hair cell. The cochleograms were coded for computer reduction of data. Intercomparisons of hair-cell damage were made in terms of variants of the three parameters of the exposure stimulus. Narrow regions of severe to total hair-cell destruction were seen in the ears exposed to higher frequency stimuli. In general, greater damage was seen in outer than in inner hair cells. This difference was greatest in ears exposed to low frequencies, in which extensive outer-hair-cell damage was seen near the apex. Relations between damage and stimulation patterns are discussed in terms of the nonlinear response of the ear to high-intensity stimulation. Author

N70-30724*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THRESHOLDS FOR THE PERCEPTION OF ANGULAR ACCELERATION ABOUT THE THREE MAJOR BODY AXES

John D. Stewart and Brant Clark (San Jose State Coll.) *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 299-306 refs (See N70-30699 16-04)

Avail: SOD $4.50; CFSTI CSCL 06S

The specific purpose was to determine thresholds for the perception of rotation about the x-, y-, and z-axes and to compare these results for the group and for the individual observers. The thresholds of 18 men with normal vestibular function were established for the x-, y-, and z-axes by use of a precision rotation device. The angular acceleration was ordered, using a random, forced-choice, double-staircase procedure, and the order of determination of the three thresholds for each observer was established by a Latin-square method. Mean thresholds were found to be equal for the x- and z-axes. The mean threshold about the y-axis (somersaulting axis) was found to be substantially greater than those about the x- and z-axes, but these differences were both just below statistical significance. There was a great range in thresholds for all three conditions. The intercorrelations among the three thresholds were not significantly different from zero. It is concluded that under optimum testing conditions, the mean thresholds about the x-, y- and z-axes are essentially the same but that the threshold about one body axis does not predict the threshold about the other two axes for a given observer. Author

N70-30725*# General Dynamics/Convair, San Diego, Calif.

EFFECT OF INSTABILITY DURING ROTATION ON PHYSIOLOGIC AND PERCEPTUAL-MOTOR FUNCTION

Bernard D. Newsom and J. F. Brady *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 307-328 refs (See N70-30699 16-04)

(Contract NAS9-6986)

Avail: SOD $4.50; CFSTI CSCL 06S

The requirement for an artificial-gravity space station has not been established because of the limited duration of space missions to date. The eventuality of such a system is generally accepted on the justification of comfort, training, facilitation of mechanical operations, and the more natural environment it offers for prolonged missions. A rotogravity environment was studied on the basis of radius requirements and rotational velocity limitations for crew habituation and performance. The added parameter that influences design and propellant costs is the stability required for the crew to operate satisfactorily. The effect of perturbation during rotation is emphasized. Author

N70-30726*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CERTAIN ASPECTS OF ONBOARD CENTRIFUGES AND ARTIFICIAL GRAVITY

Ralph W. Stone, Jr., W. M. Piland, and William Letko *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 329-346 refs (See N70-30699 16-04)

Avail: SOD $4.50; CFSTI CSCL 06S

Artificial gravity is an exceedingly complex environment within which man must work and requires habituation to the environment. There appears to be the potential of a physically induced ataxia tendency, a tendency to leg heaviness while walking, and numerous unnaturally induced acceleration phenomena. Design criteria for artificial gravity are presented which show a vehicle of 55 feet in diameter may meet potential criteria. Some limited data indicate that smaller vehicles may be satisfactory. Onboard centrifuges, which have a relatively short radius, require much larger centrifugal forces than are anticipated for basic artificial gravity and exceed some of the tolerable limits for artificial gravity. Thus a restriction of movement on centrifuges is required. Author

N70-30727*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WALKING IN SIMULATED LUNAR GRAVITY

William Letko and Amos A. Spady, Jr. *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 347-352 refs (See N70-30699 16-04)

Avail: SOD $4.50; CFSTI CSCL 06S

Experience in aircraft and in ground-based simulators indicates that man will be able to walk in lunar gravity with no apparent difficulty. Metabolic measurements indicate that the energy cost of locomotion in simulated lunar gravity is considerably less than in 1 *g*, as was found in earlier studies. The simulation technique used was unimportant for level walking, but generally had a large effect on the metabolic data obtained while ascending grades. Increases in the loads carried generally had a relatively small and inconsistent effect on metabolic costs. Changing the walking surface from a hard, smooth surface to one of sandy soil caused a large increase in the metabolic rate at the higher locomotion rate. Author

N70-30728*# Merrimack Coll., North Andover, Mass.

PROGRESS IN VESTIBULAR MODELING. PART 1: RESPONSE OF THE SEMICIRCULAR CANALS TO CONSTANT ROTATION IN A LINEAR ACCELERATION FIELD

Robert W. Steer, Jr. *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 353-362 refs (See N70-30699 16-04)

Avail: SOD $4.50; CFSTI CSCL 06S

The disparity between the experimentally evaluated time constants of objective and subjective responses to angular accelerations and the hydromechanical time constants of the semicircular canals is further accentuated by analysis of the semicircular canals as a damped hydromechanical angular accelerometer. The dynamic response characteristics of the semicircular canals to angular acceleration are shown to be an order of magnitude faster than can be observed by nystagmus and subjective responses to vestibular stimulation. In addition, it is shown that roller pump action of the flexible canalicular duct can maintain an adequate pressure differential across the cupula to give it a constant deflection. This is physiologically equivalent to a constant angular acceleration stimulus, and offers a plausible explanation for the continuous nystagmus responses that are provoked by rotation at a constant angular velocity about an axis which is not colinear with an applied acceleration field. Author

N70-30729*# Massachusetts Inst. of Tech., Cambridge.

A MODEL FOR VESTIBULAR ADAPTATION TO HORIZONTAL ROTATION, PART 2

Laurence R. Young and Charles M. Oman *In* Naval Aerospace Med. Inst. 4th Symp. on the Role of the Vestibular Organs in Space Exploration 1970 p 363-368 refs (See N70-30699 16-04)

(Grants NGR-22-009-156; NsG-577/22-09-025)

Avail: SOD $4.50; CFSTI CSCL 06S

Short-term adaptation effects are seen in subjective sensation of rotation and vestibular nystagmus. The mathematical model for semicircular canal function is improved by the addition of two adaptation terms (approximately 1/2-minute time constant for sensation and 2-minute time constant for nystagmus) to the overdamped second-order description. Adaptation is represented as a shift of reference level based on the recent history of cupula displacement. This model accounts for the differences in time constants among nystagmus and subjective cupulograms, secondary nystagmus, and decreased sensitivity to prolonged acceleration. Author

N70-30730*# Canadian Forces Medical Service, Toronto (Ontario).

A QUANTITATIVE STUDY OF VESTIBULAR ADAPTATION IN HUMANS, PART 3

Richard Malcolm *In* Naval Aerospace Med. Inst., 4th Symp. on

the Role of the Vestibular Organs in Space Exploration 1970 p 369 - 393 refs (See N70-30699 16-04)
Avail: SOD $4.50; CFSTI CSCL 06P

A mathematical model for short-term adaptation to vestibular stimuli is presented in which the physiological response is driven by a signal proportional to the difference between the peripheral end-organ response theta c and a central reference level R in such a way that dR/dt varies as (theta c-R). From this relation a transfer function is derived relating slow-phase angular velocity of resulting nystagmus to the angular velocity of head rotation. The resulting model has been tested by comparing its responses to controlled step and ramp angular velocity stimuli with those of human subjects. A close match was obtained in all cases, which strongly supports the view that significant adaptive effect is at play. The main time constant of the adaptive term was 82 seconds and the mean cupular restoration time constant T sub c was 21 seconds. It is suggested that previous values quoted for T sub c represent underestimates of the true value owing to superposition of the adaptive term described. The adaptive term accounts well for the phenomenon of secondary nystagmus, especially during either strong stimuli or prolonged rotations. Some implications of the findings in relation to clinical and aviation medicine are discussed. Author

N70-30770*# Minnesota Univ., Minneapolis. School of Public Health.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Semiannual Progress Report, 1 Jun. - 30 Nov. 1969
Irving J. Pflug Dec. 1969 92 p refs
(Grant NGL-24-005-160)
(NASA-CR-110431; SAPR-3) Avail: CFSTI CSCL 06M

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1. SURVIVAL OF MICROBIAL SPORES UNDER SEVERAL TEMPERATURE AND HUMIDITY CONDITIONS p 1 - 12 (See N70-30771 16-04)

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N70-30771*# Minnesota Univ., Minneapolis. School of Public Health.
SURVIVAL OF MICROBIAL SPORES UNDER SEVERAL TEMPERATURE AND HUMIDITY CONDITIONS
In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 1 - 12 (See N70-30770 16-04)
Avail: CFSTI CSCL 06M

Continuing experiments to measure the survival rates of bacterial spores as a function of relative humidity in sealed plastic containers at 22 C and 45 C are reported. It was found that significant die-away of Bacillus subtilis var. niger spores does occur at relatively low temperatures (45 - 60 C). This die-away is most pronounced at very high relative humidity (> 90%) but is also significant at intermediate humidities (approximately 50% or lower). The same effect was noted for natural spores but with considerably longer D-values. Glass strips, when compared to stainless steel, appear to greatly accelerate the die-away at > 50% RH. Author

N70-30772*# Minnesota Univ., Minneapolis. School of Public Health.
THE EFFECT OF HUMIDITY, LOCATION, SURFACE FINISH AND SEPARATOR THICKNESS ON THE DRY HEAT DESTRUCTION OF BACILLUS SUBTILIS VAR. NIGER SPORES LOCATED BETWEEN MATED SURFACES
In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 13 - 40 refs (See N70-30770 16-04)
Avail: CFSTI CSCL 06M

Analysis of recent experimental results is presented. The following conclusions were reached: (1) Treatment humidity has a much larger effect on D-values in an open system than it does in a mated-surface system. The treatment humidity effect may be neglible as far as the design of spacecraft sterilization cycles are concerned. (2) In the open system, both conditioning and treatment humidity affect D-value, y-intercept, and intercept ratio (IR). (3) Both the D-value and y-intercept must be considered in a discussion of microbial survival. The IR appears to be useful for discussion. (4) The mated-surface system shows a greater variability than does the open system. This is probably due to variabilities in the mated-surface package and in the off-the-shelf stainless steel used for the mated surfaces. (5) The location of spores in a mated surface has an important effect on their thermal destruction rate. The spores near the edge tend to have smaller D-values than spores at the center of the plate. Author

N70-30773*# Minnesota Univ., Minneapolis. School of Public Health.
DETECTION OF LOW LEVELS OF MICROBIAL CONTAMINATION ON SURFACES BY CHEMICAL APPROACHES
In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 41 - 43 (See N70-30770 16-04)
Avail: CFSTI CSCL 06M

Standardization processes are described for the thin-layer chromatographic procedure and the microscope photometer used to measure and evaluate the quantities of the separated nucleotides from microbial cells. The results indicate that the method produces promising results in detecting low numbers of microbial cells on surfaces. Author

N70-30774*# Minnesota Univ., Minneapolis. School of Public Health.
DRY HEAT DESTRUCTION RATES OF BACILLUS SUBTILIS VAR. NIGER IN A CLOSED SYSTEM
In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 44 - 50 refs (See N70-30774 16-04)
Avail: CFSTI CSCL 06M

The development of apparatus with an O-ring groove for determining dry heat D-values and preliminary data are described. Both Teflon and Viton O-rings were tested with equilibration conditions of 35 - 40% RH at 23 C. The Viton O-rings were chosen because of their good sealing characteristics at high temperatures (up to 204 C) and their low water absorbing properties. The heat block system appears to perform well. Author

N70-30775*# Minnesota Univ., Minneapolis. School of Public Health.
DRY HEAT DESTRUCTION RATES OF MICROORGANISMS ON SURFACES AS A FUNCTION OF RELATIVE HUMIDITY
In its Environ. Microbiol. as Related to Planetary Quarantine Dec. 1969 p 51 - 68 ref (See N70-30770 16-04)
Avail: CFSTI CSCL 06M

Experiments to determine D-values of Bacillus subtilis var. niger spores subjected to a 100 C temperature are described. Results show that heating in a dry-gas environment (< 0.03% RH) results in D-values considerably lower than those obtained by heating in an ambient environment (34-36% RH at 22 C or

0.65-0.86% at 110 C). A D-value ratio of approximately 1:4 was noted in almost every trial. A comparison of dry nitrogen and dry air did not reveal any difference between the two gases: although drier conditions were associated with nitrogen than with air. There was an indication that heating in a dry gas may have reduced the y-intercept (indicating that a sharper than usual reduction took place during the first heating interval), compared to heating in the clean room. Author

N70-30951*# Techtran Corp., Glen Burnie, Md.
PHYSIOLOGY OF THE VESTIBULAR ANALYZER
V. V. Parin, ed., et al Washington NASA Jun. 1970 250 p Transl. into ENGLISH of the book 'Fiziologiya Vestibulyarnogo Analizatora' Moscow, Nauka, 1968 p 5-240
(Contract NASw-1695)
(NASA-TT-F-616) Avail: CFSTI CSCL 06C

Papers are presented on problems related to the physiology of the vestibular analyzer of man and animals, located under conditions of terrestrial gravitation and applicable to space flight. For individual titles see N70-30952 through N70-30990.

N70-30952*# Techtran Corp., Glen Burnie, Md.
INTERACTION OF THE VESTIBULAR ANALYZER WITH OTHER ANALYZER SYSTEMS. SOME REAL PROBLEMS OF INVESTIGATING THE ANALYZER FUNCTION OF ASTRONAUTS IN FLIGHT
M. D. Yemelyanov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 1-9 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

A number of positions is put forward on the basis of analyzing disruptions of the analyzer function of cosmonauts in flight, and of experimental investigations under ground conditions. Illusory sensations of spatial orientation develop as a result of conflicting situations in perception of gravitational and visual conditioned reflex verticals. The illusions may be accompanied by motion sickness. Author

N70-30953*# Techtran Corp., Glen Burnie, Md.
VARIATION OF THE ELECTRICAL ACTIVITY OF THE BRAIN OF ANIMALS AND MAN UPON STIMULATION OF THE VESTIBULAR APPARATUS
V. G. Samsonova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 10-17 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The effect of vestibular and light stimulations on reaction of single neurons in the visual cortex of the frog, total activity of different regions of the brain and reaction of assimilating the rhythm of light flashes in animals and man are studied. Isolated and multiple stimulation of the vestibular and visual analyzers reveal a close functional relationship between them. Author

N70-30954*# Techtran Corp., Glen Burnie, Md.
ACTIVITY OF THE PHASE AND TONIC SYSTEMS OF THE OCULOMOTOR APPARATUS IN CERTAIN VESTIBULAR REFLEXES AND VESTIBULAR NYSTAGMUS
D. P. Matyushkin *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 18-21 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The phase and tonic systems of the oculomotor apparatus in rabbits during revolutions around the longitudinal axis of the body and to rotational postnystagmus is investigated. When an animal is rotated slowly around the longitudinal axis of its body in the direction of the muscle being studied, the function of the tonic system in it is intensified, and the phase system is brought into the reaction along with the tonic system upon rapid rotations. Author

N70-30955*# Techtran Corp., Glen Burnie, Md.
ELECTROPHYSIOLOGICAL INVESTIGATION OF THE INTERACTION OF THE VESTIBULAR AND VISUAL AFFERENT SYSTEMS
G. I. Gorgiladze et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 22-37 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The effect of vestibular stimulation (polarization of the labyrinth by direct current) on stimulation in the visual system and on the activity of individual neurons in the visual cortex of the cat is studied. Results of the experiments show that the effect of polarizing the labyrinth on the primary visual cortex of the cat is of a nonspecific nature. Author

N70-30956*# Techtran Corp., Glen Burnie, Md.
A MATHEMATICAL MODEL OF THE OCULOMOTOR APPARATUS
A. A. Petrov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 38-43 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

A mathematical model of the OMA is proposed in the form of the aggregate of neuron networks which function according to physiological principles. A qualitative explanation of certain reflex movements of the eyes is given, and results are presented of experiments on an OMA model run on an electronic computer. Author

N70-30957*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF POSTURE ON THE SENSORY-MOTOR COORDINATION OF MAN
A. A. Koreshkov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 44-47 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

Results are presented of experiments, in which test subjects executed complex movements during different positions of the body in space. Severe changes in the movements of the subjects were revealed, especially in the horizontal position. The data obtained in the experiments are considered with respect to the interaction of the vestibular, visual and motor analyzers. Author

N70-30958*# Techtran Corp., Glen Burnie, Md.
ON THE INTERACTION OF CERTAIN ANALYZERS UPON FORMATION OF MOTOR REACTIONS OF ANIMALS DURING WEIGHTLESSNESS
L. A. Kitayev-Smyk *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 48-55 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Reactions to brief periods of weightlessness are described in cats and rabbits which are healthy, have one- or two-sided labyrinthectomies, or which are deprived of vision. The tonic and motor components are distinguished in the motor activity of the animals. Behavioral reactions of animals during weightlessness develop due to the effect of two competing information flows—from the gravireceptors and from the visual analyzer. Author

N70-30959*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE ADJUSTABLE REFLEXES OF ANIMALS DURING WEIGHTLESSNESS
L. A. Kitayev-Smyk *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 56-63 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Experiments on cats and rabbits during weightlessness in a parabolic trajectory showed the following: 1) a sequential vestibular adjusting reaction which brings about the rotation reaction after disappearance of gravity; 2) a vestibular adjusting reaction which stabilizes the position of the head in space during weightlessness; 3) a cervical adjusting reaction which causes straightening of the head and body with respect to the axis of the animal. Author

N70-30960*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF THE INTERACTION MECHANISMS OF THE VISUAL AND VESTIBULAR ANALYZERS
N. G. Medvedeva *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 64–69 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

The problem of the possible mechanism of interaction of the visual and vestibular analyzers is considered. The bioelectric potential of various regions of the brain and retina are recorded in a state of rest, and during single and rhythmic light stimulations in healthy and mute subjects. The interaction of these analyzers takes place at the level of the cortical-subcortical analyzer systems.
Author

N70-30961*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF VISUAL STIMULATION ON NYSTAGMUS, FROM DATA OF ELECTRONYSTAGMOGRAPHY, IN THE PRESENCE OF TUMORS OF THE POSTERIOR CRANIAL FOSSA
N. S. Blagoveshchenskaya *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 70–76 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

Visual stimulation may intensify or retard spontaneous and caloric nystagus even in the same patient during dynamic investigation. This depends on the intensity of the stimulation and its characteristics (rhythmic light or a single light flash), and on application of additional stimuli (the caloric test). All characteristics of spontaneous and caloric nystagmus were altered by light stimulation in patients with tumors of the posterior cranial fossa, and periods of caloric nystagmus (phase culmination) were altered.
Author

N70-30962*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF PROLONGED SLOW ROTATION ON HEARING
I. Ya. Yakovleva et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 77–80 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

A study was made of the effect of the prolonged stay of man (3 and 10 days) in a rotating room at a velocity of 40 and 10 deg/sec on the functional state of the auditory analyzer. Variations in hearing were found which exceed the individual spread of the norm, and functional shifts were more severe after 3-day rotation at a velocity of 40 deg/sec, and were maintained for 5–6 hours after the experiment.
Author

N70-30963*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF CENTRIFUGAL FORCE ON CALORIC NYSTAGMUS
V. A. Kislyakov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 81–84 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Variations in the thresholds of caloric thermal nystagmus in pigeons due to the effect of centrifugal force (0.1–1.0 g), acting in the tail-head or head-tail direction, were studied. Characteristic variations in the thresholds (both an increase and decrease) and the direction of nystagmus were found, depending on the magnitude and direction of the effect of centrifugal force.
Author

N70-30964*# Techtran Corp., Glen Burnie, Md.
CHARACTERISTICS OF THE FUNCTIONAL STATE OF THE OTOLITHIC APPARATUS UNDER CONDITIONS OF VARIABLE WEIGHT
Ye. M. Yuganov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 85–88 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The functional state of the otolithic apparatus was studied under conditions of weightlessness and G-loads using galvanometry and a method of direct otolithometry. It was revealed that under conditions of brief periods of weightlessness, thresholds to current and linear acceleration increase uniformly, on the basis of which it is concluded that weightlessness is a specific stimulus of the vestibular apparatus.
Author

N70-30965*# Techtran Corp., Glen Burnie, Md.
MICROELECTRODE INVESTIGATION OF THE VESTIBULAR NEURONS OF THE MESENCEPHALON
I. I. Leshchinyuk et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 89–93 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The effect of afferent vestibular pulsation on neuron activity of the inferior tubers of the lamina quadrigemina was investigated under conditions of direct current polarization and acoustical and caloric stimulation of the labyrinth. The experiments were conducted on decerebralized cats. The presence of neurons in the inferior corpus bigeminum was shown. The type of reaction of neurons studied is broader than that in the vestibular neurons of the medulla oblongata.
Author

N70-30966*# Techtran Corp., Glen Burnie, Md.
MICROELECTRODE INVESTIGATION OF NEURON REACTIONS OF THE VESTIBULAR NUCLEI ON THE CAT UPON POLARIZATION AND CALORIC STIMULATION OF THE LABYRINTHS
G. I. Gorgiladze *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 94–106 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Activity of vestibular neurons and the nature of their reaction to stimulation of the ipsi- and contralateral labyrinths, and also the effect of intravenous administration of strychnine to explain the nature of the interaction between vestibular nuclei are investigated in detail. It is concluded that interaction between contralateral vestibular nuclei is brought about by direct commissural connections
Author

N70-30968*# Techtran Corp., Glen Burnie, Md.
ON THE FUNCTIONAL RELATIONSHIP BETWEEN THE SEMICIRCULAR CANALS AND THE OTOLITHIC APPARATUS
A. Ye. Kurashvili et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 115–119 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

It was established that when the combined effect of angular and centrifugal accelerations act on man and animals (rabbits, cats and dogs), the angular velocity of eye movement increases during the slow phase of pulses of rotational nystagmus. An increase begins at the moment G-loads take effect and continues until rotation reaches a constant velocity. An attempt is made on the basis of the data obtained to explain the effect of weightlessness on man.
Author

N70-30969*# Techtran Corp., Glen Burnie, Md.
ON THE FUNCTIONAL STATE OF THE VESTIBULAR APPARATUS OF RATS DURING HYPOTHERMY
I. I. Voinova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 120–123 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

The characteristics of post-rotational nystagmus in rats were studied during the dynamics of developing artificial hypothermy at a body temperature of 37-20 deg. When body temperature was lowered to 33–34 deg, the intensity of nystagmus was increased; cooling the rats to 28–27 deg and below caused post-rotational nystagmus to diminish, and the reaction disappeared completely at 20 deg.
Author

N70-30970*# Techtran Corp., Glen Burnie, Md.
SENSORY MOTOR REACTIONS OF MAN UNDER THE EFFECT OF ROTATION ON A LOW-RADIUS INSTALLATION

S. S. Markaryan et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 124 - 127 ref (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Investigations were carried out on a special stand which permits variation in the position of a subject's body with respect to the vertical rotation axis. Rotation around an axis passing through the region of the pelvis with the subject in a vertical position is acceptable for no more than 20 min at a velocity of 1.5 - 2.0 rps. Rotation around axes passing through the region of the head, heart and feet are tolerated much worse. Author

N70-30971*# Techtran Corp., Glen Burnie, Md.
THE PROBLEM OF MOTION SICKNESS AND INCREASED SENSITIVITY TO VESTIBULAR EFFECTS. ON THE PROBLEM OF VESTIBULO-VEGETATIVE REFLEXES DUE TO THE EFFECT OF CORIOLIS ACCELERATION
A. S. Kiselev *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 128 - 132 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Studies on 40 subjects revealed that the severity of vestibulo-vegetative and vestibulo-somatic reactions is greater during active tilting backward and forward than during tilting forward and backward. On this basis a new test which determines the degree of vestibular resistance to Coriolis acceleration is proposed for vestibular selection and conditioning of cosmonauts. Author

N70-30972*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF PROLONGED ROTATION AND CORIOLIS ACCELERATIONS ON THE VESTIBULAR FUNCTION OF MAN
R. R. Galle *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 133 - 137 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Fourteen experiments were conducted in a rotating chamber at a velocity of 10 and 40 deg/sec lasting up to 7 days. Some results of investigating the function of the vestibular analyzer during rotation are presented. It is proposed that prolonged rotation tests be used as diagnostic tests to determine the tolerance of man to vestibular effects. Author

N70-30973*# Techtran Corp., Glen Burnie, Md.
INVESTIGATIONS OF SLEEP IN MAN UNDER CONDITIONS OF PROLONGED ROTATION
F. D. Gorbov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 138 - 148 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Rotation of test subjects at an angular velocity of 10 deg/sec over a period of days had no significant effect on the quality of nocturnal sleep. Relatively superficial sleep was determined by factors of a circumstantial nature (uncomfortable bed, temperature discomfort, vibrations, etc.) rather than by rotation. Seven-day rotation at the same velocity decreased the depth of sleep (according to EEG data) without disrupting wellbeing. Author

N70-30974*# Techtran Corp., Glen Burnie, Md.
SOME DYNAMIC INDICATORS OF THE VESTIBULAR ANALYZER UNDER THE EFFECT OF CORIOLIS ACCELERATION
V. G. Strelets *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 149 - 155 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effect of prolonged Coriolis accelerations on rated athletes was studied. Vegetative reactions, and also shifts in static and dynamic equilibrium, post-rotational nystagmus and dynamometry were recorded. Grouping according to professional affiliation (flying or technical personnel) did not reveal any substantial differences between the groups. Author

N70-30975*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF DEVELOPMENT OF LATENT FORMS OF MOTION SICKNESS
A. N. Petrov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 156 - 160 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Motor responses to light signals were studied in 77 subjects with the help of a special device mounted on a two-beam swing. The time of complex sensory motor reactions, the amount of information perceived and processed and the capacity of the visual analyzer were determined. Statistically reliable variation of the indicators determined was revealed in seven subjects with the absence of visible signs of motion sickness. Author

N70-30976*# Techtran Corp., Glen Burnie, Md.
ON THE INTERRELATIONSHIP OF THE FUNCTIONAL TOLERANCE OF THE VESTIBULAR ANALYZER AND THE STATE OF ARTERIAL PRESSURE DURING MOTION SICKNESS
D. A. Pigulevskiy et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 161 - 165 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effect of the tenfold otolithic test on arterial blood pressure (BP) and pulse rate was investigated. BP, measured by the oscillographic method in persons resistant to motion sickness, remains unchanged or increases briefly upon vestibular stimulation. Hypotonia (57%) was noted in most persons prone to motion sickness. Author

N70-30977*# Techtran Corp., Glen Burnie, Md.
ON THE ROLE OF THE ADAPTATION FUNCTION OF SYMPATHETIC INNERVATION IN PREVENTION OF MOTION SICKNESS
V. P. Fomina-Kosolapova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 166 - 172 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Testing the effect on the excitability of the vestibular apparatus of a rabbit using sympatholytic (sympatholytin, piperoxane and pyridoxiphene), sympathomimetic (adrenaline and ephedrine) substances was carried out. Sympathomimetics caused a decrease in the number of nystagmic pulses during rotation and a reduction in post-rotational nystagmus. The sympatholytics, except for piperoxane, have the opposite effect. Author

N70-30979*# Techtran Corp., Glen Burnie, Md.
ON THE NONSPECIFICITY OF VESTIBULAR CONDITIONING
B. B. Bokhov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 177 - 181 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06C

Results presented are obtained in rabbits, which indicate the nonspecific nature of acclimatization to vestibular stimulation. After the animals had been conditioned to a single stimulus, a weakening was observed in the reaction of nystagmus in response to stimuli which were greater or less in value than the conditioning stimulus. Author

N70-30980*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF MOTION SICKNESS ON THE FUNCTIONAL STATUS OF THE HYPOPHYSIS-CORTEX SYSTEM OF THE ADRENAL GLANDS
N. I. Kastrov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 182 - 185 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effect of stimulating the vestibular apparatus on the content of regular elements of the blood was studied. It was established that rocking healthy subjects in a Khilov swing for 15 minutes leads to a distinct reduction of the eosinophils in the blood within 4 hours. Author

N70-30981*# Techtran Corp., Glen Burnie, Md.
MOTION SICKNESS IN DOGS BEFORE AND AFTER INTRAVENOUS ADMINISTRATION OF SODIUM HYDROCARBONATE
A. G. Kuznetsov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 186 - 188 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The effectiveness of intravenous administration of hydrocarbonate and a prophylactic substance during motion sickness (vertical linear accelerations) was studied in three dogs. A two-time administration of 10 ml of a 5% solution at two-week intervals had a positive effect, which was expressed in a decrease in the frequency and severity of motion sickness symptoms. Author

N70-30982*# Techtran Corp., Glen Burnie, Md.
DEVELOPMENT OF NEW METHODS OF INVESTIGATING THE VESTIBULAR FUNCTION. THE ADI TEST AND ITS SIGNIFICANCE FOR FUNCTIONAL INVESTIGATION AND CONDITIONING OF THE VESTIBULAR ANALYZER
A. Kh. Minkovskiy *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 189 - 194 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06P

The combination of quantitative and qualitative characteristics of vestibulo-somatic, vegetative and sensory reactions, observed as a result of using measured angular accelerations, decelerations and tilting (the ADI test) in various planes, provides broad possibilities for correct analysis of the functional state of the vestibular analyzer. Author

N70-30983*# Techtran Corp., Glen Burnie, Md.
CERTAIN REFLEXES OF THE SEMICIRCULAR CANALS WITH RESPECT TO PROFESSIONAL SELECTION AND EVALUATION OF FLIGHT PERSONNEL
V. I. Babiyak *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 195 - 199 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The author proposes investigating the vestibular function with the help of positive and negative angular accelerations of 20 deg/sq sec. A definite relationship was discovered between illusions and nystagmus. The phase nature of variations in the indicators analyzed is emphasized. Author

N70-30984*# Techtran Corp., Glen Burnie, Md.
ANALYZING THE RAPID COMPONENT OF NYSTAGMUS IN NYSTAGMOGRAPHIC INVESTIGATIONS
M. M. Levashov *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 200 - 203 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The nature of the rapid component of nystagmus is investigated with the help of photonystagmography. An attempt is made to give the quantitative characteristics of the rapid component of nystagmus. It is proved that the rapid component depends on afferent pulsation of the ampullar apparatus and may serve as a valuable indicator of the dynamics of the cupula. For total analysis of one cycle of nystagmus, it is recommended that the average harmonic velocity of the rapid and slow phases be used. Author

N70-30987*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF METHODS OF STUDYING THE VESTIBULAR FUNCTION IN A SPACESHIP
A. D. Matveyev et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 213 - 224 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Some ways and methods of investigating the vestibular analyzer under conditions of weightlessness are proposed. Adequate stimuli in this case may be the various movements of the cosmonaut's head and body, and rotation of the spaceship itself. The importance of complex investigation of the vestibular analyzer with recordings of EOG, EMG and EEG is emphasized. Author

N70-30988*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF THE IMPORTANCE OF PARABOLIC FLIGHT TO REPRODUCE BRIEF PERIODS OF WEIGHTLESSNESS IN VESTIBULAR EVALUATION OF COSMONAUTS
I. A. Kolosov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 225 - 229 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

The possibility of using parabolic flights to create brief periods of weightlessness for vestibular selection of cosmonauts is considered. It was shown that parobolic flights reveal persons who are prone to motion sickness. The use of additional vestibular stimulation during weightlessness helps to reveal persons with latent forms of motion sickness. Author

N70-30989*# Techtran Corp., Glen Burnie, Md.
THE SIGNIFICANCE OF CERTAIN VESTIBULOMETRIC TESTS IN MEDICAL FLIGHT EXAMINATION OF PERSONNEL PREDISPOSED TO ILLUSORY SENSATIONS DURING FLIGHT
I. A. Sidelnikov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 230 - 236 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

A chair with an unstable platform, pulsed current, a rotating chair with unstable platform and a rotating cylinder for optokinetic stimulation were used to study proneness to illusions of spatial orientation. It was discovered that increased susceptibility to pulsed current indicates a high probability of development of illusory sensations. Author

N70-30990*# Techtran Corp., Glen Burnie, Md.
COMPARATIVE ANALYSIS OF VESTIBULOMETRIC METHODS OF EXAMINATION USED FOR PURPOSES OF PROFESSIONAL SELECTION
S. R. Raskatova *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 237 - 243 (See N70-30951 16-04)
Avail: CFSTI CSCL 06S

Three tests were compared in order to find more sensitive methods of vestibulometry during medical flight examination. Examinations of 900 subjects indicated that DPK is the simplest and most economical method timewise, revealing increased sensitivity of the vestibular apparatus to the effect of adequate stimulation when other methods are less indicative. Author

N70-31010*# California Univ., Berkeley. Space Sciences Lab.
CONSTITUENCY AND ORIGINS OF CYCLIC GROWTH LAYERS IN PELECYPOD SHELLS
Richard McNeil Barker (Ph.D. Thesis) [1969] 277 p refs *Its* Ser. 11, Issue No. 43
(Grant NGR-05-003-067)
(NASA-CR-110441) Avail: CFSTI CSCL 06C

Growth layers occurring in shells of 98 species of pelecypods were examined microscopically in thin section and as natural and etched surfaces. Study began with shells of eleven species known from life history investigations to have annual cycles of growth. Internal microstructural features of the annual layers in these shells provided criteria for recognition of similar, apparently annual shell increments in eighty-six of eighty-seven other species. All of the specimens feature growth laminae, commonly on the order of 50 microns in thickness. The specimens from shallow marine environments show either a clustering of growth laminae related to the formation of concentric ridges or minor growth bands on the external shell surface. Based on observations of the number of growth laminae and clusters per annual-growth layer, it was

hypothesised that the subannual increments may be related to daily and fortnightly (and in some cases monthly) cycles in the environment. Author

N70-31026*# Franklin Inst., Philadelphia, Pa. Research Labs.
EFFECTS OF PUROMYCIN ON POWER SPECTRAL DENSITY AND EVOKED RESPONSE OF VISUAL CORTEX AND HIPPOCAMPAL ELECTRICAL ACTIVITY Final Report
Anthony Marmarov [1970] 49 p refs Prepared in cooperation with Maryland Univ., Baltimore. Psychiat. Inst.
(Contract NASw-1841)
(NASA-CR-110127; F-C2430) Avail: CFSTI CSCL 06E

Experiments were conducted on development and analysis of cortically evoked potentials from deep brain structures in response to bipolar electrical stimulation. Four electrophysiologic parameters were obtained in response to direct stimulation of the optic tract: evoked response of visual cortex and hippocampal regions and electrical activity of these regions under non-stimulus conditions. The responses to electrical stimulation show a marked reduction in amplitude following injection of puromycin. No significant changes were observed in latency of primary and secondary peaks. Amplitude of the secondary peak in the hippocampal regions was suppressed to a greater degree than that of the visual cortex. Author

N70-31055*# Scientific Translation Service, Santa Barbara, Calif.
HISTAMINE IN ALCOHOLIC BEVERAGES [HISTAMIN IN ALKOHOLHALTIGEN GETRAENKEN]
P. Marquardt et al Washington NASA Jun. 1970 7 p refs Transl. into ENGLISH from Arzneimittel-Forsch. (Aulendorf), v. 13, no. 12, 1963 p 1100 - 1102
(Contract NASw-2035)
(NASA-TT-F-13055) Avail: CFSTI CSCL 06A

The presence of considerable quantities of histamine in several varieties of white, red, and sparkling wines as well as in beer was demonstrated with biological and chemical methods. The significance of the findings with regard to wine quality and evoked reactions is discussed. Author

N70-31057*# Collaborative Research, Inc., Waltham, Mass.
STUDIES ON STABILIZATION OF ENZYMES Final Report
15 May 1970 48 p refs
(Contract NAS2-4525)
(NASA-CR-73460) Avail: CFSTI CSCL 06A

Dilute, aqueous solutions of beef heart lactate dehydrogenase (LDH), (the model enzyme) were stabilized under standardized conditions permitting a retention of 100% enzymatic activity for over 20 months. Significant stabilization of E. coli B asparaginase and pig heart malate dehydrogenase was also achieved in dilute aqueous media. Lactate dehydrogenase was insolubilized in an enzymatically active form, by being covalently bound to the insoluble support, diazotized Cellex PAB. Optimum binding ratios were derived and studies completed permitting the regeneration of bound and unbound enzyme. Antibodies to LDH were successfully produced in rabbits. Such antibodies were to be used as enzyme stabilizers. Other studies, including the selective alkylation of nonessential sulfhydryl groups of LDH by reaction with gamma-chloropropylthiosulfate were performed. Author

N70-31156# Oklahoma Univ., Oklahoma City. Dept. of Physiology and Biophysics.
MOTOR EFFECTS FROM VISUALLY INDUCED DISORIENTATION IN MAN
M. Herbert Brecher and Gerhard A. Brecher FAA Nov. 1969 13 p refs
(Contract FA-67-AC-2699-1)
(FAA-AM-69-23) Avail: CFSTI

Egocentric disorientation can be experienced by a pilot if the entire visual environment moves relative to his body without a clue of the objective position of the airplane in respect to the ground. Subjects were placed into an optokinetic drum which excluded any stationary objects from view. The walking pattern in the stationary drum served as a control. In the experimental situation the drum was rotated at various constant speeds. With faster drum speeds the deviations became systematically greater. Volitional attempts to correct the deviations after some training resulted in a fairly straight walk in a few subjects, but most subjects were not able to do so while a few persons overcompensated in the opposite direction. It is concluded that the visually induced disorientation in space overrides the sensory input from all other modalities when stationary objective targets are excluded. Author

N70-31169# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
AN ANALYTICAL DESCRIPTION OF THE LINE ELEMENT IN THE ZONE-FLUCTUATION MODEL OF COLOR VISION
J. J. Vos and P. L. Walraven 1970 89 p refs
(IZF-1970-5; TDCK-55424) Avail: CFSTI

A mathematical description is given of color discrimination which rests on the three pillars listed. Color processing occurs in a Helmholtz type three receptor-zone, followed by a Hering type neural-conversion-zone in which a luminance (L) and two antagonistic (R vs G and Y vs B) signals are formed. Color discrimination is essentially photon-noise limited; at higher luminances saturation processes come in, which keep color discrimination below this theoretical limit. The recording of the receptor output occurs in such a way that the L, R vs G, and Y vs B signals together form a set of conjugate parameters with respect to the discrimination-determined metrics of the color space. The line element (yardstick to measure color differences) is calculated for various stages of nervous saturation and for various degrees of color vision deficiency, inclusive normal. Author

N70-31176*# Exotech, Inc., Washington, D.C. Systems Research Div.
INVESTIGATIONS INTO A DIFFUSION MODEL OF DRY HEAT STERILIZATION Interim Report
M. J. Barrett 5 May 1969 17 p refs
(Contract NASw-1734)
(NASA-CR-110611; TRSR-041) Avail: CFSTI CSCL 06M

The analytical model described formalizes the hypothesis that dry heat inactivation of microorganisms is closely related to the water content of the spore and its micro-environment. Experimental data are examined relative to this model and it appears to be valid. This model is aimed at overcoming the well known deficiencies of the logarithm model. Author

N70-31177*# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Aerospace Medicine Dept.
EVALUATION OF NEW PENETRATING SPORICIDE POTENTIALLY USEFUL IN SPACECRAFT STERILIZATION Progress Report
C. Aldridge and G. J. Womack 15 May 1969 26 p refs
(Contract NAS8-30157)
(NASA-CR-110612; PR-3) Avail: CFSTI CSCL 06T

Potting, elastomeric, and epoxy compounds are discussed as sources of heavy microbiological contamination of spacecraft. A sporicide made from a mixture of ethylene oxide and dimethyl sulfoxide was investigated for its ability to penetrate plastics, layers of grease, or soil to kill spores placed in or beneath such materials. The sporicide was also studied for its ability to penetrate paints, silicone rubber, epoxy cements, and certain plastics so that such materials become self sterilizing as they cure. R.B.

N70-31193# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEDICAL AND BIOLOGICAL RESEARCH

20 Feb. 1970 28 p Transl. into ENGLISH from the Russian
(AD-704012; FTD-HT-23-622-69) Avail: CFSTI CSCL 6/3

The article deals with a series of experiments on the effects of prolonged weightlessness on healthy individuals, animals, plants, and microorganisms under simulated laboratory conditions with the help of clinically physiological, biochemical, roentgenological, and other methods. Protective measures, life support systems, and the possibility of life on other planets were investigated. Author (TAB)

N70-31198# Texas Technological Univ., Lubbock. Center of Biotechnology Fatigue and Human Performance.
EVENT FREQUENCY MEMORY AND CATEGORIZATION PERFORMANCE AS A FUNCTION OF CONDITIONS OF FEEDBACK
Nathan R. Denny and Henry C. Gruemmer, Jr. 23 Mar. 1970 14 p Presented at the Southwestern Physchol. Assoc. Meeting, Austin, Tex., 17-19 Apr. 1969
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703848) Avail: CFSTI CSCL 5/10

The purpose of the study was to investigate human statistical discrimination as a variety of memory performance which is subject to interference of a predicted kind, and the extent to which it is also influenced by feedback and motivational considerations. Human stimulus event frequency discrimination was studied in the context of two time-shared categorization tasks of differing complexities. Author (TAB)

N70-31199# Texas Technological Univ., Lubbock. Center of Biotechnology Fatigue and Human Performance.
MEMORY PERFORMANCE AND TIME-SHARED TASK COMPLEXITY
Nathan R. Denny 1969 16 p refs Presented at the Rocky Mt. Psychol. Assoc. Meeting, Albuquerque, N. Mex., 15 May 1969 Sponsored in part by Tex. State Res. Grant
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703868) Avail: CFSTI CSCL 5/10

The experiment tests the view that statistical behavior is a variety of memory performance that is differentially interfered with by time-shared tasks of differing complexity. Author (TAB)

N70-31221# Texas Technological Univ., Lubbock.
PERFORMANCE OF A VISUAL TASK DURING RECOVERY FROM PHYSICAL LOADING
J. D. Ramsey, M. M. Ayoub, and H. S. Edgar 11 Mar. 1970 21 p refs Presented at the Work Physiol. Symp., Kansas City, Kans., 26 Sep. 1969
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703865) Avail: CFSTI CSCL 6/19

A human operator may be required to perform a visual task under a variety of conditions of physical loading. The task may be performed during a condition of rest, during some level of physical loading, or during a recovery period after physical loading. This study is an attempt to investigate the visual performance of digit recognition during the recovery period. The experimental paradigm for this study successfully generated a set of physiological responses which were well behaved, properly spaced and of proper magnitude. These could well serve as a good basis for correlation with task performance scores, if such scores exhibited any distinguishable trend. The visual digit identification task of this study exhibited a highly variable response which was not significantly affected by either work intensity or the period of recovery. Neither an aroused effect of better performance after work, nor a detrimental effect of poorer performance after work was observed. Author (TAB)

N70-31288# Joint Publications Research Service, Washington, D.C.
THE BEHAVIOR OF DOLPHINS IN CAPTIVITY
V. M. Belkovich et al 10 Jun. 1970 22 p ref Transl. into ENGLISH from Priroda (Moscow), Nov. 1969 p 18-28
(JPRS-50701) Avail: CFSTI

The behavior of white-bodied and bottlenose dolphins in captivity, the relationships of the animals, the structure of the communities, their games, their adaptations to new conditions and the changes in their behavior caused by these adaptations are observed. Author

N70-31294# Leiden Univ. (Netherlands).
THE INFLUENCE OF X-RAYS AND ULTRAVIOLET RADIATION ON NUCLEIC ACIDS OF HETEROPLOID HUMAN CELLS IN TISSUE CULTURE [DE INVLOED VAN ROENTGENSTRALING EN ULTRAVIOLET LICHT OP NUCLEINE]
Paul Herman Maria Lohman (Ph.D. Thesis) 1969 138 p refs In DUTCH; ENGLISH summary
Avail: CFSTI

The investigations were carried out with multiplying cells in monolayer cultures. Both asynchronous cultures and cultures which were synchronized by the excess thymidine method were used. The induction and rejoining of breaks in DNA after irradiation were studied and the influence of radiation on the synthesis of various RNA fractions was analyzed. Author

N70-31311# Washington State Univ., Pullman. Dept. of Agronomy.
RELATIONSHIP OF RADIATION INDUCED DAMAGE IN BARLEY SEEDS TO THE INHIBITION OF CERTAIN OXIDOREDUCTASES BY SODIUM AZIDE
E. G. Sideris, R. A. Nilan, and C. F. Konzak [1969] 15 p refs
(Contract AT(45-1)-353)
(SM-121/12; RLO-353-36) Avail: CFSTI

The effects of sodium azide post-treatment on seedling height and number of chromosome aberrations during first mitotic division in shoot tips were studied using barley (Hordeum vulgare) seeds given 16 Krad of Co-60 gamma irradiation. Sodium azide exhibited an inhibitory effect on the growth of seedlings, particularly when the seeds were treated in acidic solutions. Chromosome aberrations were not detectable with sodium azide alone, but increased with treatment by both sodium azide and radiation over radiation alone. It was concluded that under acidic conditions, an interaction between the chemical and ionizing radiation treatment was present. The synergism between sodium azide and radiation and its association with a decreased catalase peroxidase, and respiratory activity is in agreement with basic postulates of radiobiology. NSA

N70-31332# RAND Corp., Santa Monica, Calif.
CHEMICAL EQUILIBRIUM PROBLEMS WITH UNBOUNDED CONSTRAINT SETS
James H. Bigelow, James C. de Haven, and Norman Z. Shapiro Feb. 1970 25 p refs
(Contract F44620-67-C-0045)
(AD-702789; RM-5952-PR) Avail: CFSTI CSCL 7/4

An investigation of the use of mathematical models to explore the chemical aspects of physiological systems; this deals with the theoretical and computational aspects of understanding the chemistry of human physiological function. The question of existence of solutions to problems having unbounded constraint sets is investigated by relating their existence (or nonexistence) to a property of a solution to an auxiliary chemical equilibrium problem with a bounded constraint set. An example system is selected consisting of gases in contact with an aqueous buffer solution at a uniform total hydrostatic pressure and temperature. The numerical problem of determining the amount of CO2 to be added to achieve a specified partial pressure of CO2 in the gas phase, and its effects on the composition of the total system, is solved by using a

procedure suggested by the concept of unbounded constraint sets. Findings may apply to design of artificial life-support systems needed in extraterrestrial environments related to Air Force missions. Author (TAB)

N70-31334# Texas Univ., Austin. Center for Research in Water Resources.
RADIOACTIVITY TRANSPORT IN WATER Summary Report
Yousef A. Yousef, Akira Kudo and Earnest F. Gloyna Feb. 1970 80 p refs
(Contract AT(11-1)-490)
(ORO-490-20; EHE-70-5; CRWR-53; TR-20) Avail: CFSTI

A transport model is presented which describes the behavior of radionuclide movement in an ecological system, and considers hydraulic transport, sediment sorption and desorption, and biomass uptake and release. Solution of the transport model are programmed and verified using data obtained from the laboratory ecosystem and the research flume. The limitations and relative importance of environmental factors affecting transport were evaluated. Recommendations for the use of this prediction model are discussed. Flume experiments limited to fresh water systems and slow-moving streams were conducted. In general, radionuclide movement followed the same pattern as Rhodamine B dye releases. However, discrepancies were observed due to interactions of radionuclides with sediments, biomass and organic debris. The effects of specific environmental factors such as pH, temperature, dissolved oxygen, and oxidation-reduction potential of sunlight were studied to estimate the uptake and release rates of radionuclides. Author (NSA)

N70-31336# New York Univ., N.Y. Dept. of Environmental Medicine.
THE TUMORIGENIC ACTION OF BETA, PROTON, ALPHA, AND ELECTRON RADIATION ON THE RAT SKIN Progress Report, 1 Apr. 1961 – 31 Mar. 1970
Roy E. Albert 31 Mar. 1970 37 p refs
(Contract AT(30-1)-2785)
(NYO-2785-4) Avail: CFSTI

Research in progress is reported on the effect of pore size on tumor induction in rat skin by proton irradiation in a sieve pattern; the effect of hole size and spacing on hair follicle damage produced by sieve pattern; the damage produced by sieve pattern; the effect of hole size damage produced by sieve pattern irradiation; the comparative skin tumor and injury response to soft X-rays and other forms of ionizing radiation in rats; the basis for the low susceptibility of the mouse to radioinduced skin tumors; theoretical considerations and experimental techniques for the demonstration of a G-phase in epidermis; DNA loss replacement in irradiated skin; the incorporation of BUdR into the DNA of skin; the effect of dose fractionation on tumor induction in rat skin, tumor induction by freezing; and the use of croton resin to promote radiation-initiated tumors. NSA

N70-31355# Texas Technological Univ., Lubbock.
VIGILANCE: AN ANNOTATED BIBLIOGRAPHY
Charles G. Halcomb and Peggy J. Blackwell Aberdeen Proving Ground, Md. Aberdeen Res. and Develop. Center Nov. 1969 203 p refs
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-703918) Avail: CFSTI CSCL 5/10

Vigilance, or monitoring behavior, has been of interest to researchers since World War 2. Research activity has not only continued over the past 25 years, but has increased at an ever progressing rate. This bibliography was compiled to meet the need for a continuing program of research into the problem associated with recovery from the classical vigilance decrement, and is presented with annotations in the hope that it will be of value to investigators in the field. Author (TAB)

N70-31408# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
DETERMINATION OF CENTERS OF GRAVITY OF INFANTS
J. J. Swearingen, J. M. Badgley, G. E. Braden, and T. F. Wallace Nov. 1969 9 p refs
(FAA-AM-69-22) Avail: CFSTI

Recent efforts to provide effective restraint equipment for crash protection of infants in our transportation complex and to develop satisfactory flotation equipment for the little ones have revealed that there is a lack of data concerning the location of the c.g. (center of gravity) of this age group. Various body measurements were made on approximately 135 infants ranging in age from 2 months to 36 months and their c.g. determined from several body reference points on a specially constructed c.g. machine. Determinations of c.g. locations were made for the standing position only (actually supine) and it was found that the means distance of the c.g. above the crotch for a 2-month-old infant (6.0 inches) is very close to that for a full-grown adult (5.9 inches). Author

N70-31412# Washington State Univ., Pullman. Dept. of Agronomy.
INFLUENCE OF RADIATION ENERGY ON THE OXYGEN ENHANCEMENT RATIO IN IRRADIATED BARLEY SEEDS
P. J. Bottino, R. A. Nilan, and C. F. Konzak 28 Oct. 1969 32 p refs
(Contract AT(45-1)-353)
(RLO-353-39) Avail: CFSTI

Barley seeds were brought to water contents of 2 to 14%. Irradiation was accomplished with either Co-60 gamma source that delivered a dose at 1.25 MeV energy or with an X-ray source that delivered energies of 50, 100, 150, or 300 kV, all at 10 mA. After irradiation, the seeds were hydrated immediately in either oxygen-or nitrogen-bubbled water at 0 C. Four experiments were designed to study the following: the interrelation of oxygen, radiation energy, and seed water content; the relation of oxygen enhancement ratio (OER) and radiation energy in terms of chromosome aberration frequencies; free radical production by each energy of radiation; and the effects of radiation energy on the postradiation oxygen effect. The OER decreased with increasing water content independent of the energy used. The number of dicentric bridges per cell and fragments per cell decreased from 1.25 MeV to 100 kV, then increased at 50 kV. Author (NSA)

N70-31416# Missouri Botanical Garden, St. Louis.
ENERGY EXCHANGE WITHIN ECOSYSTEMS Annual Technical Progress Report, 15 May 1969 – 14 May 1970
David M. Gates 14 May 1970 12 p refs
(Contract AT(11-1)-1711)
(COO-1711-9; ATPR-3) Avail: CFSTI

The theoretical relationship between a plant leaf and its immediate environment was tested with respect to its energy budget. Other questions concerning plant productivity, competition among plants, succession in plant communities, and ecological adaptation with respect to leaf morphology are also discussed. The relationship of energy flow to the temperature and transpiration rate of a plant is investigated. A theoretical model is derived to describe the process of photosynthesis in plant leaves. R.B.

N70-31417# South Dakota Univ., Vermillion. School of Medicine.
EFFECTS OF ULTRAVIOLET RADIATION ON ALGAE: MECHANISM OF INACTIVATION AND REPAIR Annual Progress Report, 1 May 1969 – 30 Apr. 1970
Gary D. Small 30 Apr. 1970 4 p
(Contract AT(11-1)-1793)
(COO-1793-2) Avail: CFSTI

Photoreactivating enzyme activity was found in Ochromonas danica (Chrysophyta), Euglena gracilis (Euglenophyta), and Chlamydomonas reinhardi (Chlorophyta). Studies were initiated to

determine if enzyme activities of chloroplasts and nuclei were caused by two different proteins. Studies on detection of uv-induced photoproducts in DNA of algae included effects of deoxynucleosides on uptake of radioactive thymine by DNA of Euglena. Experiments were conducted on effects of caffeine and acriflavine on survival of uv-irradiated Euglena and on dark repair mechanisms of Euglena. Studies on enzymes in Chlamydomonas that may be involved in excision-repair mechanisms were begun.
NSA

N70-31427# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
MEDICAL RESEARCH INSTITUTE FOR CAISSON WORK ACTIVITY REPORT 1965 – 1968 [BERICHT UEBER DIE TAETIGHEIT DER AERZTLICHEN FORSCHUNGSSTELLE FUER CAISSONARBEITEN IN DEN JAHREN 1965 BIS 1968]
O. Wuensche *In its* 3rd Working Session Decompression Diseases Sep. 1969 p 9 – 17 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Reported are theoretical aspects and experimental studies on responses of functional biological systems to gas bubble formation during decompression and the preventive effects of: (1) induced fever; (2) sinus shaped vibrations; (3) noise; (4) narcotic, sedative, and stimulating drugs; (5) ferments; and (6) diuretic and antiphlogistic medication. Emphasis is placed on a combination of reduced decompression time and oxygen inhalation that reduces decompression sickness in compressed air workers considerably.
Transl. by G.G.

N70-31434# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
OBSERVATIONS AND EXPERIENCES WITH HYPERBARIC OXYGEN THERAPY IN BRAIN DAMAGE [BEOBACHTUNGEN UND ERFAHRUNGEN MIT DER HYPERBAREN SAUERSTOFFTHERAPIE BEI HIRNGESCHAEDIGTEN]
K. H. Holbach and U. Goett *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 91 – 109 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Electroencephalogical tracings are used to observe the degree of effectiveness of the high oxygen pressure treatment in brain damage cases. Inhalation of oxygen at two to three atm pressure over a period of two to three hours improved severe brain trauma remarkably in five out of six cases; even patients with arterial brain vessel blockages show improvement during or after oxygen inhalation therapy in high pressure chambers. Pathologically changed delta wave patterns in damaged brain activities changed to a pattern of more frequency and even alpha waves after treatment. Transient deteriorations in electric brain activity were only observed in a few cases where pressures of more than 3 atm together with treatment durations of more than three hours were used. It is shown that high pressure oxygen treatment at two to three atm for two to three hours is beneficial in acute, severe brain damaged patients.
Transl. by G.G.

N70-31437# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
STATISTICAL EVALUATION OF COMPRESSED AIR SICKNESSES [STATISTISCHE AUSWERTUNG VON DRUCKLUFTKRANKHEITEN]
Th. Peters *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 125 – 132 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Developed are accident insurance criteria for compressed air workers for the use of industrial physicians in civil engineering projects. The proposed questionnaire contains besides the usual personnel data a list of physiological indices including pathological test results and clinical diagnosis. The considered decompression treatment depends on working conditions before the onset of decompression sickness, the atmospheric pressure environment during work, and the conditions after release from the decompression chamber.
Transl. by G.G.

N70-31440# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
THE TREATMENT OF SEVERE DECOMPRESSION SICKNESSES [DIE BEHANDLUNG SCHWERER DRUCKFALLKRANKHEITEN
P. Cabarrou *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 161 – 167 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

The successful treatment of two cases of decompression sickness in deep sea divers is described. Emphasized is the immediate fast descent in a decompression chamber to pressures corresponding to 70 meter depth and extended decompression step times of 30 minutes between each 5 to 5 meters. The author examined and interrogated patients during decompression and not before and thus was able to keep his method flexible according to observed improvements of pathological symptoms. Recompression to 70 m depth reduces the gas bubble diameter in half and thus produces better absorption in the patients tissues.
Transl. by G.G.

N70-31441# Deutsche Vorsuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
CAISSON SICKNESS AND THE NERVOUS SYSTEM [CAISSONKRANKHEIT UND NERVENSYSTEM]
I. Rozsahegyi *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 169 – 176 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Discussed are frequency and variations of clinical aspects in acute decompression sicknesses of the central nervous systems observed in depth foundation and underground construction workers. Multifocal syndroms of brain stem and spinal lesions are outlined by a few case histories with emphasis on the progressive slow development of secondary chronical after-effects. Characteristic neurological disturbances are expressed in pathological reflexes of the extremities and skin, impotence, disturbed vestibular functions, EEG patterns, etc. The only effective therapy constitutes recompression of the patient combined with oxygen inhalation and extremely slow, protracted discharge from the decompression chamber. If only a partial success is obtained, subsequent symptomatic treatment with intraveneous injections of 10 milliliter (ml) of a 2 percent novocain solution results in improvement. The severity and severe results of neurological disturbances underline the necessity of decompression sickness prevention in high pressure construction technology.
Transl. by G.G.

N70-31472# Hebrew Univ., Jerusalem (Israel). Dept. of Psychology.
REACTIONS TO STRESS Final Scientific Report, 1 Jan. 1967 – 1 Nov. 1969
Sol Kugelmass 1 Nov. 1969 5 p refs
(Contract AF 61(052)-839)
(AD-702852; AFOSR-70-0790TR) Avail: CFSTI CSCL 5/10

Consideration of the data of a series of experiments on Israeli Police trainees and criminal suspects suggests that differential psychophysiological reactivity of the GSR channel is not systematically reduced by stress within the range relevant to

criminal interrogation. Further analysis of the criminal suspect data suggested that the detection rate could be raised through the combination of responses from the three polygraph channels (GSR, Breathing, and Blood Pressure). This was particularly so for subjects having positive correlations between the different channel responsivities. In a most recent replication study using a different sample of criminal suspects somewhat different results were obtained with very low rates of detection in the breathing and blood pressure channel responses. Further analysis of this data is being undertaken. In still a different sample of criminal suspects a pattern of baseline heart-rate change was noted that seemed to be systematically related to the individuals GSR differential reactivity and detectibility. Author (TAB)

N70-31532# Oregon State Univ., Corvallis. Radiation Center.
STUDIES ON ENVIRONMENTAL POLLUTION BY MISSILE PROPELLANTS Final Report, 1 Jul. 1967 – 30 Jun. 1969
Frank N. Dost and Chih H. Wang Wright-Patterson AFB, Ohio AMRL Jan. 1970 46 p refs
(Contract F33615-67-C-1750)
(AD-704126; AMRL-TR-69-116) Avail: CFSTI CSCL 21/9

The effects of NF3O on lower organisms have been surveyed. The gas causes minimum damage to plants when exposed for 30 minutes to concentrations as low as 5 ppm. Effects on goldfish maintained in aquaria under 1% NF3O for 30 minutes were negligible; salmon were moderately sensitive. Microorganisms in soil were only slightly decreased in numbers by one hour of exposure by continuously tumbling soil particles through 1% NF3O. Potentially useful decontamination reastions were studied. Interhalogens and N2F4 can probably be removed from the atmosphere by a mist of aqueous sodium bicarbonate solution. No reagent portable enough and sufficiently effective to remove OF2 and NF3O gas from the atmosphere was found. NF3 is virtually non-reactive. Author (TAB)

N70-31555# Washington State Univ., Pullman.
A STUDY OF FACTORS GOVERNING PLANT RADIOSENSITIVITY Annual Progress Report, 1 Nov. 1968 – 31 Oct. 1969
Robert A. Nilan and C. F. Konzak 15 Nov. 1969 9 p refs
(Contract AT(45-1)-353)
(RLO-353-42) Avail: CFSTI

Progress is reported for studies to identify and elucidate mechanisms by which biological (especially genetic and cytogenetic) damage is induced, prevented, and repaired in irradiated plant cells. The role of gibberellic acid and sodium azide in the development and/or prevention of the free radical-catalase-peroxidase-peroxide pathway was emphasized and preliminary work was done to determine the effects of radiation on DNA and the interrelation among DNA changes, mutations, and chromosome aberrations in plant cells. Understanding of the initial physico-chemical mechanisms involved in the different components of damage was furthered. The development of standardized methods for the automatic storage and retrieval of information on induced mutants and other plant germ plasma stocks was continued. A list of publications during the report period is provided. NSA

N70-31556# Washington State Univ., Pullman. Dept. of Agronomy.
THE INFLUENCE OF TEMPERATURE ON RADIATION-INDUCED OXYGEN DEPENDENT AND INDEPENDENT DAMAGE IN BARLEY SEEDS
B. V. Conger, J. R. Hileman, R. A. Nilan, and C. F. Konzak [1970] 17 p refs
(Contract AT(45-1)-353)
(RLO-353-40) Avail: CFSTI

Himalaya barley seeds of 10.0% water content were exposed in a partial vacuum to various doses of Co-60 gamma rays at different temperatures ranging from −78 to 50 C. In one set of experiments the seeds were hydrated immediately after irradiation in either oxygenated or oxygen-free water at 0 C. In another series of experiments the seeds were stored for various periods of time at different temperatures before hydration. Changes in free radical signal during post-irradiation storage under comparable conditions were measured by EPR in one experiment. The oxygen enhancement ratio (OER) was found to be greatest in seeds irradiated at lower temperatures. The OER decreased as the temperature during irradiation was increased. There was no observable oxygen-effect (OER = 1) if the seeds were irradiated at 50 C. Although oxygen-dependent damage decreased with increasing irradiation temperature, oxygen-independent damage increased. A decrease in oxygen-dependent damage during storage was observed with increasing storage temperature. The development of a long term oxygen-independent damage component became apparent in irradiated seeds stored at 30 and 50 C. Author (NSA)

N70-31570# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DATA ON THE STUDY OF BACTERIAL CONTAMINATION OF ATMOSPHERIC AIR OF THE CITY OF ODESSA
O. Yu. Grigorashchenko et al 25 Feb. 1970 12 p refs Transl. into ENGLISH from Mikrobiol. Zh., Akad. Nauk Ukr. SSR (Kiev), V. 25, no. 1, 1963 p 35–41
(AD-704021; FTD-HT-23-35-70) Avail: CFSTI CSCL 13/2

During the years of 1958 to 1960 the city bacteriological laboratory of Odessa conducted systematic bacteriological investigations of atmospheric air. Air samples were taken by means of a Krotov apparatus and by the precipitation method at eight points in the city of Odessa. The largest content of microorganisms were observed at points Nos. 1, 3, 5, and 8. In winter the quantity of microbes in 1 m super 3 of air was considerably lower than in summer. During rainfall or snowfall the number of colonies was two, three, or even four times less than the standard quantities in dry weather. Attention is drawn to the fact that 784 strains of representatives of the intestinal group of bacteria were isolated; of them 7 were Flexners dysentery bacilla, 1 was a Newcastle dysentery bacillus, 1 was a Boyd Novogrodsky dysentery bacillus and 2 were Morgans bacilli. Of the 524 isolated strains of intestinal bacilli, 24 were agglutinated with O coli serums, 17 of them with Flexners serum. Author (TAB)

N70-31656# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PATHOMORPHOLOGICAL AND HISTOCHEMICAL CHANGES IN THE ORGANS OF TURTLES ON BOARD THE AUTOMATIC STATION ZOND-5
N. A. Gaidamakin et al 30 Jan. 1970 17 p refs Transl. into ENGLISH from the Russian
(AD-704042; FTD-HT-23-618-69) Avail: CFSTI CSCL 6/3

The Zond 5 automatic station carried two steppe turtles on a circumlunar flight. Two turtles were subjected to the same ground transport as the experimental group and four specimens were retained in the vivarium as an undisturbed control sample. Hematological, pathomorphological, histochemical and EKG procedures were used to investigate the biological effects of space flight and ground disturbance on the animals. A process using combined tissue blocks from different animals for histological and histochemical studies is described. Tissue photo micrographs illustrate the findings. The use of the disturbed control group made it possible to separate changes due to spaceflight from those due to transport and caging on the ground. (Fifteen figures are included in the parent document, which is available on microfiche). Author (TAB)

N70-31684# Armed Forces Radiobiology Research Inst., Bethesda, Md.
ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE

Annual Research Report, 1 Jul. 1968 – 30 Jun. 1969
30 Jun. 1969 56 p ref
(AD-704167; AFRRI-ARR-3) Avail: CFSTI CSCL 6/18

Contents include: Acute mortality response of larger mammals to ionizing radiation; Investigation of incapacitating doses of radiation in larger mammals; The effect of partial-body shielding; Acute mortality of mice and rats exposed to 14 MeV neutrons; Behavioral incapacitation studies; The behavioral performance of the unrestrained monkey following mixed gamma-neutron irradiation; Identification of prominent sites of radiation injury; Hemogram and bone marrow differential of the chinchilla; Effects of ionizing radiations on biosynthesis of complex proteins; Effect of mixed gamma-neutron radiations on plasma and urine amino acid levels in the rat; Effects of ionizing radiation on immune responses; Postirradiation gastrointentinal injury; and Radiation fields produced by the afrri-triga reactor. TAB

N70-31669# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF EVALUATING THE BACTERIAL SEEDING OF ATMOSPHERIC AIR
S. I. Kudryavtsev et al 20 Feb. 1970 10 p refs Transl. into ENGLISH from Lab. Delo (Moscow), no. 3, 1968 p 164 – 168
(AD-704014; FTD-HT-23-20-70) Avail: CFSTI CSCL 13/2

The article concerns the use of various devices to evaluate bacterial seeding of the atmosphere and to develop a device to study the isokineticity of aerosol sampling. Author (TAB)

N70-31670# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPORTANCE OF CULTURE MEDIUM COMPOSITION IN DETERMINING MICROBE CONTAMINATION OF AIR
G. N. Ishchenko et al 20 Feb. 1970 5 p Transl. into ENGLISH from Med. Zh. Uzbekistana (USSR), no. 2, 1963 p 48
(AD-704018; FTD-HT-23-26-70) Avail: CFSTI CSCL 6/13

The purpose of this work is to clarify the importance of medium composition in bacteriological studies of the air. In parallel air studies using the Krotov device and the jar-cup method the following medias were used: simple meat peptone agar, sugar agar, and agar with rabbit blood. Study of the air in one and the same enclosure was carried out ten times at different periods. The cups were kept in a thermostat at 37 degrees for 40-48 hours, after which the colonies were tabulated and the number of microorganisms in 1 cu m of air were calculated. The composition of the culture medium is of great importance. Both in air seedings using the Krotov device and in using the Jar-cup method, the colonies grew least of all on simple agar. On sugar agar with the jar-cup method, the number of colonies increased from 1.5-6 times. The number of bacteria grew even more on blood agar. It can be recommended that bacteriological contamination of the air should be determined by using only medias with blood. TAB

N70-31688# Princeton Univ., N.J. Elementary Particles Lab.
PIEZOELECTRIC MECHANICAL-MICROPIPETTE STIMULATOR
G. T. Reynolds 12 Feb. 1970 12 p refs
(Contract AT(30-1)-3406)
(NYO-3406-18; TR-10) Avail: CFSTI

A simple mechanical stimulating technique is described which is capable of controlled displacements and provision of a time reference for the precise initiation of the stimulus. The method was successful with several luminescent organisms that did not respond to the usual electrical techniques. It consists of incorporating a thin walled piezoelectric cylinder as an integral part of the suction micropipette that holds the specimen. Specific results are presented for Noctiluca, Pyrocystis, Gonyaulax, and ctenophore Mnemiopsis. Author

N70-31767# Northeastern Univ., Boston, Mass. Dept. of Biophysics and Biomedical Engineering.
BIOLOGICAL EFFECTS OF LASER RADIATION Annual Progress Report, 1 Oct. 1968 – 30 Sep. 1969
Samuel Fine and Edmund Klein Sep. 1969 16 p refs
(AD-704363) Avail: CFSTI CSCL 6/18

A summary of studies carried on during the year on (1) Anterior chamber measurements on CO2 corneal irradiation; (2) corneal calcification on CO2 laser irradiation; (3) ocular injury from CO2 laser irradiation; (4) application of thermal models to retinal threshold injury; (5) toxic and explosive hazards associated with lasers; (6) pathology of internal viscera following laser irradiation; (7) a method for detecting and measuring frequency of surface vibrations using a helium neon laser; (8) exploration of potential carcinogenic effects of pulsed laser irradiation; (9) lasers in biology and medicine; and (10) rupture and tensile strength measurements of fresh and treated canine aortic tissue. Author (TAB)

N70-31783# Naval Submarine Medical Center, Groton, Conn. Research Lab.
A PRELIMINARY INVESTIGATION OF THE EFFECTS OF NEAR INFRARED RADIATION ON VISUAL PERFORMANCE
Kevin V. Laxar (M.S. Thesis—Connecticut Univ.) 7 Jul. 1969 18 p refs
(AD-703613; SMRL-588) Avail: CFSTI CSCL 6/16

Simulated solar, near infrared radiation caused no eye damage or decrement in visual discrimination performance in Rhesus monkeys. The subjects tended to avoid the radiation, however. The study tests for a safe level of irradiance for repeated exposure to the near infrared in operational settings. Distance from the source is the limiting factor in exposure to infrared searchlights and signaling devices. No change in visor specification is required to protect Navy personnel from the suns near infrared radiation, even at high altitudes. Author (TAB)

N70-31784# Navy Experimental Diving Unit, Washington, D.C.
REPETITIVE EXCURSION DIVES FROM SATURATED DEPTHS ON HELIUM-OXYGEN MIXTURES. PHASE 1: SATURATION DEPTH 350 FEET
James K. Summitt, Jerry M. Herron, and Edward T. Flynn 15 Mar. 1970 55 p refs
(AD-703610; NEDU-RR-2-70) Avail: CFSTI CSCL 6/19

Five 350 foot saturation dives were conducted at the Navy Experimental Diving Unit to verify a no-decompression, repetitive excursion format developed by DSSP (PM-11). Twenty divers completed a total of 344 man-excursion dives from the saturation depth. No symptoms of decompression sickness were reported during the excursion dives, during the bottom time at 350 feet or during the first 200 feet of decompression back to the surface. Five cases of decompression sickness did occur during the latter stages of decompression and they are discussed briefly. The occurrance of compression arthralgia and external otitis on deep saturation-excursion dives is also discussed. Author (TAB)

N70-31793# School of Aerospace Medicine, Brooks AFB, Tex.
NYSTAGMUS COMPUTATION BY ANALOG TECHNICS Final Report, 15 Feb. 1968 – 28 Oct. 1969
F. A. Brogan Feb. 1970 15 p refs
(AD-702809; SAM-TR-70-7) Avail: CFSTI CSCL 6/2

A complete system is described for on-line reduction of nystagmic data during vestibular bithermal caloric testing. The total eye movement in one direction for each 5-second interval is plotted in degrees by an X-Y recorder. A different symbol is used for each test condition. The operator does not have to be familiar with the computer system once it is set up since all controls to the computer are automatic. Control room operation is limited to adjustment of the gain of the raw data recorder for a calibrated eye movement and the changing of symbols on the X-Y point print,

plotter after each stimulation. A standard analog computer can be used for processing the data, or a special computer may be constructed. Author (TAB)

N70-31814*# Gulf General Atomic, San Diego, Calif.
A STUDY TO DEVELOP NEUTRON ACTIVATION FOR MEASURING BONE CALCIUM CONTENT
H. R. Lukens, Jr., D. M. Fleishman, and J. K. MacKenzie
Washington NASA Jun. 1970 84 p refs
(Contract NAS2-5178)
(NASA-CR-1606) Avail: CFSTI CSCL 06B

A study of the feasibility of utilizing neutron activation analysis for the *in vivo* determination of bone calcium in the macaque monkey has been carried out. Theoretical calculations showed that the absolute determination of bone calcium by *in vivo* neutron activation analysis is highly dependent on the use of comparator standards that accurately represent the size, shape, and composition of the specimen. Accurate models of a vertebra and a femur were constructed of calcium-loaded plastic, and analyses of two vertebrae and a femur were carried out under simulated *in vivo* conditions using the models as comparator standards. The absolute calcium values were confirmed by both high-flux neutron activation analysis and atomic absorption analyses. With sufficiently accurate comparator standards, it is estimated that *in vivo* neutron activation analysis is capable of determining absolute calcium levels in the whole body to within 2% to 3% of the actual value. Author

N70-31845*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE DEVELOPMENT AND APPLICATION OF PLETHYSMOGRAPHIC AND ISOTOPIC METHODS FOR STUDYING THE RELATIONSHIP BETWEEN INTRINSIC AUTOREGULATION OF BLOOD FLOW AND THE PARTITION OF INTERCOMPARTMENTAL FLUID VOLUMES IN SKELETAL MUSCLE
William Carter Alexander (Ph.D. Thesis—Wake Forest Univ.) Jun. 1970 68 p refs
(Grants PHS-G-HE-00487; PHS-G-HE-5392)
(NASA-TM-X-58045) Avail: CFSTI CSCL 06P

Data are presented which indicate that in the denervated canine gracilis muscle, an intrinsic mechanism is operative which is an integral part of the autoregulation of blood flow. The maintenance of constant flow to the exchange elements of the circulation despite wide fluctuations in arterial perfusion pressure provides, in addition, a regulation of capillary hydraulic pressure which defines the balance between ultrafiltration and reabsorption of fluid. This mechanism leads to an intrinsic autoregulation of solvent exchange and stable intravascular and extravascular volumes in the muscle bed. This intrinsic regulation of the exchange networks of skeletal muscle interferes with the desired systemic regulation by depleting the volume in the capacitance reservoir and reducing venous return. It may be predicted that the intrinsic response of the muscle to maintain its intravascular and extravascular volumes essentially constant during reductions in perfusion pressure is, in part, a significant contributor to the irreversible phase of hypotensive shock. Author

N70-31882# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETECTION OF STRONG CARCINOGENS: 1,2,4,5 AND 3,4,9,10-DIBENZOPYRENES IN ATMOSPHERIC AIR
P. P. Dikun 21 Jan. 1970 6 p refs Transl. into ENGLISH from Vopr. Onkol. (Moscow), v. 12, no. 1, 1966 p 90–91
(AD-704040; FTD-HT-23-614-69) Avail: CFSTI CSCL 7/4

Isomers of dibenzopyrene were isolated from air collected in Leningrad and identified by means of quasi-linear spectra. Wavelengths of quasi-linear fluorescence spectra of the pure and airborne isomers are given. TAB

N70-31905*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CREW RADIATION DOSE FROM A GAS-CORE NUCLEAR ROCKET PLUME
Charles C. Masser 1970 14 p refs Presented at 16th Ann Meeting of the Am. Nucl. Soc., Los Angeles, 28 Jun.–2 Jul. 1970
(NASA-TM-X-52832) Avail: CFSTI CSCL 18F

Analytical calculations are performed to determine the radiation dose rate to the crew of a gas-core nuclear rocket from the fission fragments located throughout the plume volume. The rocket plume is generated by the products of the reactor and consists of hydrogen, uranium, and fission fragments. A total of 1.68 pounds of fission fragments are formed from a gas-core rocket that produces one million pounds of thrust at a specific impulse of 1500 seconds for a propellant consumption of one million pounds. The radiation dose rate from these fission fragments to two crew locations of 250 and 500 feet from the nozzle exit are calculated. The doses are calculated assuming that there is a vacuum in the space between the crew and the plume. Author

N70-31928*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
May 1970 147 p refs
(NASA-SP-7011(76)) Avail: CFSTI CSCL 06B

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N70-31998*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY
Jan. 1970 880 p refs
(NASA-SP-7011(72)) Avail: CFSTI HC $10.00/MF $0.65 CSCL 06B

The compiled abstract index supplements the 1969 issues of the bibliography on Aerospace Medicine and Biology. It comprises references on bioscience and biotechnology prepared from: (1) NASA entries by STAR accession numbers; (2) AIAA entries by AIAA accession numbers; and (3) LC entries identified by numbers of the A 69-80000 series. G.G.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-30823*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM (EC/LSS) FOR THE 1975 SPACE STATION
Hubert B. Wells 15 Apr. 1970 95 p refs
(NASA-TM-X-64508) Avail: CFSTI CSCL 06K

The results are presented of a preliminary study to define an environmental control and life support subsystem that is applicable to a long term, earth orbital space station for the 1975

time period. The space station is capable of supporting a 12-man crew continuously over an extended period of time with regular resupply. The EC/LSS must maintain a system life requirement of 10 years through maintenance spares and redundancy. A survey was made to define a group of assemblies that is suitable for fulfilling the requirements of the EC/LSS. The primary assemblies are as follows: atmospheric supply and pressurization; oxygen recovery; atmospheric purification; thermal control; water management; water reclamation; waste management; suit loop/PLSS; crew systems; and expendables. Author

N70-30834# Advisory Group for Aerospace Research and Development, Paris (France).
SURVEY OF PROBLEMS AND TOPICS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 6-15 (See N70-30833 16-21)
Avail: CFSTI

Human factors problems associated with ground control systems are studied. Some of the influences on the form in which they originate and on the manner in which they are solved are briefly surveyed, and probable reasons for the neglect of certain problems and the preoccupation with others are suggested. These influences include the purpose of the system, military or civil manning, and the country in which the problem occurs. The association between human factors and certain other disciplines in the solution of problems is indicated, together with possible future trends in human factors work. Author

N70-30835# Advisory Group for Aerospace Research and Development, Paris (France).
STAGES OF HUMAN FACTORS CONTRIBUTIONS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 16-27 (See N70-30833 16-21)
Avail: CFSTI

The role of human factors which depends on the stage in the evolution of the system at which it begins to contribute is analyzed. Seven stages are distinguished, at each of which a distinct contribution can be made. The earlier the stage at which human factors advice is available, the more probable it is that its requirements are met in the operational system, obviating costly remedial measures. General human factors questions, appropriate at each stage, are compiled, which together illustrate the function of human factors in ground control systems. Author

N70-30838# Advisory Group for Aerospace Research and Development, Paris (France).
THE ANALYSIS OF SYSTEMS AND JOBS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 39-49 (See N70-30833 16-21)
Avail: CFSTI

Some of the reasons for describing and analysing systems and jobs are noted. Trials of the system may be less adequate if a detailed system description is not available, and the development of a selection procedure for operators relies on a full description of the system and the job so that the required attributes of operators may be deduced. Various factors associated with the description of jobs and systems are examined, including general principles and practices applied to the study of man and his tasks in systems. Examples of vigilance tasks and the effects of faulty equipment on the operator are used to illustrate the difficulties of obtaining accurate descriptions of jobs done under operational conditions. Several factors are difficult to include or control in descriptions and trials of systems and jobs, and the effects of these on the findings obtained from descriptions and trials are assessed. Author

N70-30839# Advisory Group for Aerospace Research and Development, Paris (France).
DESIGN AND ASSESSMENT OF DISPLAYS AND CONTROLS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 50-62 (See N70-30833 16-21)
Avail: CFSTI

Research on displays has been far more extensive than that on controls, but has nevertheless failed to deal adequately with many display problems, because it has been concentrated on topics which affect the fine detail of the appearance of the display rather than the broad features of its design. Choice of display type is influenced more by technical considerations than by human factors. Numerous studies of search and vigilance tasks in the laboratory have not solved the human factors problems in the corresponding tasks under operational conditions. Issues such as large versus small displays, individual versus group displays, and vertical versus horizontal displays have still to be settled, and the value of alphanumeric data has received less consideration than its legibility. Work on display contexts has emphasised ambient lighting and console design. Controls specified for various tasks have seldom been compared with each other, but there has been greater interest in control types than in their sensitivity. Display-control relationships cannot usually be specified in general terms, but are task dependent. Author

N70-30841# Advisory Group for Aerospace Research and Development, Paris (France).
MAN IN THE MAN-MACHINE SYSTEM
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 70-78 (See N70-30833 16-21)
Avail: CFSTI

Man's relation to machines depends on the extent to which he controls them or is dependent on them, since his role in the system and his satisfaction may be influenced by the responsibilities he retains. Several broad issues have to be considered before a function is allocated to man or machine. Many of the criteria used for allocation seem to be applied, in an arbitrary way, and the principles underlying the allocation process are disputed. Man as a system component does a variety of tasks, such as decision making, tracking and vigilance, and methods for training him to be more efficient are sought and tried out. As a component he is not very reliable, he is affected by stress, and the effort he makes is determined by numerous factors. The effects of effort relate more to job satisfaction than to performance. Man forms attitudes towards his work which have not been studied. Maintenance is mostly done by man, and new training methods in maintenance are intended to improve man's ability to locate and correct faulty equipment. Author

N70-30842# Advisory Group for Aerospace Research and Development, Paris (France).
INDIVIDUAL DIFFERENCES
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 79-87 (See N70-30833 16-21)
Avail: CFSTI

Individual differences are seldom concerned with the unique features of an individual operator, but deal with differences among operators according to various measurable traits and attributes, and their effects on system efficiency. The process of selection is intended to minimise the adverse effects of individual differences on system efficiency and to select for training those individuals most likely to become proficient. Selection may be based on a few carefully selected traits, or on numerous relatively unselected ones. In either case, periodic follow-up studies are necessary to validate the selection procedure. Automation is affecting both the nature of the individual operator's tasks and the methods by which he is trained to do them. In addition to the traits which feature in selection procedures, further important individual differences relate to age, to the effects of stress and shift work on the operator, to his working environment and to his medical fitness. Operators differ significantly in their performance of most tasks, such as vigilance, decision-making, and communicating with others. Author

N70-30843# Advisory Group for Aerospace Research and Development, Paris (France).
THE ROLE OF SIMULATION
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 88 - 91 (See N70-30833 16-21)
Avail: CFSTI

In ground control systems, simulation is employed for training, for evaluation, and for research. Simulation has been extended to include games, models, and fast-time simulation, and to examine new or proposed procedures and items of equipment. The value of simulation has been acknowledge almost from the inception of ground control systems. The emphasis on displays which occurred in early work has become less pronounced with the increasing concern to simulate large segments of systems and teams of operators. The validity of most findings obtained by simulation techniques can seldom be assessed with confidence and accuracy; nevertheless, more trust can be placed in items evaluated by simulation than in those which have not been properly evaluated at all. Author

N70-30844# Advisory Group for Aerospace Research and Development, Paris (France).
MEASUREMENT OF PERFORMANCE
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 92 - 100 (See N70-30833 16-21)
Avail: CFSTI

Measures of performance may refer primarily to the system or to an operator within it. They are often adversely affected by the numerous practical constraints limiting the sorts of measures which can be taken and the conditions under which they are obtained. For certain purposes, measures of actual operating systems are taken, but these must be passive and not disrupt the functioning of the system in any way. Most measures use simulated systems and tasks, often with small numbers of subjects. Measures include the study and evaluation of selection, training and maintenance procedures. Computers have affected measurement by encouraging the building of mathematical models and by influencing instructional techniques. For some tasks, such as vigilance, measures have been taken in the laboratory and often do not apply operationally. For other tasks, such as tasks performed by teams, operational situations have been simulated and traditional tools for measurement, developed in the laboratory, have been neglected. Some of the problems encountered in measuring man in ground control systems are discussed. Author

N70-30845# Advisory Group for Aerospace Research and Development, Paris (France).
IDENTIFICATION OF FACTORS RELEVANT TO TASK PERFORMANCE
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 101 - 107 (See N70-30833 16-21)
Avail: CFSTI

The factors of potential relevance to the performance of most ground control tasks are very numerous. Some can be discovered directly or indirectly by means of quite standard techniques, such as check lists, flow diagrams, and job requirements. Other methods rely on observing the operator at work and judging what factors influence his actions. Many factors, related to training and expectancies for example, are present, but their importance is difficult to gauge quantitatively. Often, factors can be identified from formal or informal assessments by the operators themselves. Factors may be revealed by equipment innovations, by changes in research or teaching methods, such as the introduction of programmed learning, or by revised opinions on what is relevant to, or part of, human factors. They may also appear when, for any reason, the difficulty of a task changes. Author

N70-30846# Advisory Group for Aerospace Research and Development, Paris (France).
RELEVANCE OF OTHER RESEARCH FINDINGS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 109 - 113 (See N70-30833 16-21)
Avail: CFSTI

Sources of findings of potential relevance to ground control systems, both in other applied work and in the laboratory are analyzed. In general, the human factors worker must be satisfied that the findings themselves are valid and that they were obtained under similar circumstances to those in ground control systems before their potential relevance can be established. They should then be treated as hypotheses requiring verification in the ground control context. Applied work of potential relevance may be in human factors, work study, ground control systems, industrial psychology, or social psychology, or in subdivisions or adjuncts of these disciplines. The basic theoretical work of greatest potential interest is probably that on learning, memory, skill, perception, motivation, of personality, though from time to time other topics may become relevant. Author

N70-30877*# National Aeronautics and Space Administration, Washington, D.C.
FIFTH ANNUAL NASA-UNIVERSITY CONFERENCE ON MANUAL CONTROL
1970 720 p refs Conf. held at Cambridge, Mass., 27-29 Mar. 1969 Sponsored jointly by NASA and MIT
(NASA-SP-215) Avail:CFSTI HC$10.00/MF$0.65 CSCL 05E

Summaries are presented on research on quasi-linear models, display systems, optimal control methods, adaptive and discrete models, human performance theory, neuromuscular models, monitoring, and applications of manual control. For individual titles see N70-30878 through N70-30912.

N70-30878*# University of Southern Calif., Los Angeles.
IDENTIFICATION OF HUMAN OPERATOR MODELS BY STOCHASTIC APPROXIMATION
C. B. Neal (Hughes Aircraft Co.) and G. A. Bekey *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 3 20 refs (See N70-30877 16-05)
(Grant NGR-05-018-022)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The application of stochastic approximation to the estimation of human operator model parameters is discussed. Both continuous and sampled-data models are considered. Stochastic approximation was used successfully for parameter estimates in both types of models. In the case of sampled data models, all parameters, including the sampling interval, are estimated. Author

N70-30879*# National Aeronautics and Space Administration, Electronics Research Center, Cambridge, Mass.
APPLICATION OF A MODIFIED FAST FOURIER TRANSFORM TO CALCULATE HUMAN OPERATOR DESCRIBING FUNCTION
Richard S. Shirley *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 21 - 47 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A version of the fast Fourier transform (FFT) is used in a hybrid computer program to permit processing of tracking data to yield the human operator's describing function almost immediately after the period of data-taking. The use of the FFT allows the final calculation time required to process 216 seconds of tracking data to be reduced to 3 seconds from the 10 minutes previously required on the same computer. The algorithm used permits the bulk of the analysis of the data to be performed while the data are being taken, and does not require all the data to be present in core before processing begins. Author

N70-30880*# National Aeronautics and Space Administration, Flight Research Center, Edwards, Calif.
NONLINEAR TIME-DOMAIN MODELS OF HUMAN CONTROLLERS

Lawrence W. Taylor, Jr. *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 49 65 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Earlier studies of linear models for human control response are reviewed. The results of nonlinear time-domain analysis are discussed and the method of selecting the maximum memory time and the order of the nonlinear model is described. Some results of orthogonal expansion of the weighting functions for reasons of data compression and reduction computation are presented and discussed. Author

N70-30881*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME EXAMPLES OF PILOT/VEHICLE DYNAMICS IDENTIFIED FROM FLIGHT TEST RECORDS
Rodney C. Wingrove, Frederick G. Edwards, and Armando E. Lopez *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 67 71 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Mathematical functions describing the combined pilot/vehicle dynamics were used extensively in earlier studies to analyze manned control systems. In these studies, the describing functions were measured in simulated tracking tasks using carefully controlled forcing functions to excite the pilot/vehicle dynamics. During routine flight tests, there are no carefully controlled forcing functions. Therefore, if describing functions are to obtained from this type of flight test record, an alternate identification technique is required. Such a technique that allows identification from routine operating records was presented earlier for identification of the pilot describing function. The application of this technique to the identification of the combined pilot/vehicle describing function is outlined and some preliminary results calculated from selected flight test records are presented. Author

N70-30882*# Calif. Univ., Berkeley. Dept. of Industrial Engineering and Operations Research.
APPLICATION OF GABOR'S ELEMENTARY-SIGNAL THEOREM TO ESTIMATION OF NONSTATIONARY HUMAN SPECTRAL RESPONSE
E. R. F. W. Crossman and H. Peter Delp *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 73-106 refs (See N70-30877 16-05)
(Grant PHS-UI-00016-02)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The problem of estimating the human operator's non-stationary spectral response using stationary force-functions or his stationary response using transient inputs is considered from a statistical viewpoint. The disadvantages of using a moving boxcar data-window to form sequential estimates are discussed as is the uncertainty relationship which controls the compromise between frequency and time resolution. Empirical verification is provided for simulated and human data, in the transient input case, and for filter response data in the time-varying parameter case. Author

N70-30883*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PILOT DESCRIBING FUNCTION MODELS FOR NONLINEAR CONTROLLED ELEMENTS
Leon C. Duggar, James T. Mannen, and Russell A. Hannen *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 107 110 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The performance of human pilot describing function models and human tracking subjects with nonlinear controlled elements are presented and compared. Nonlinear controlled elements were considered in order to simulate a manual control system representing a limited or backup flight control system that exhibits control displacement saturation on rate saturation characteristics. The results show that an equivalent gain representation of the system nonlinear element is possible using describing function models for slight and moderate levels of nonlinear action. Further, the adjustment rules for the parameters of the describing function models are predictable for the class of controlled elements considered. Author

N70-30884*# University of South Florida, Tampa. Coll. of Engineering.
A STUDY OF THE VARIABILITY OF HUMAN OPERATOR PERFORMANCE BASED ON THE CROSSOVER MODEL
August L. Burgett *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 111128 refs (See N70-30877 16-05)
(Contract NASr-54(06))
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A parameter identification method based on regression analysis is used to analyze human operator performance in two compensatory tracking experiments. The parameters which are estimated and analyzed are human operator gain K and time-delay to be based on the crossover model. The approach taken in the analysis of the parameter values is to divide the variance of both K and tau, based on 20-second data intervals, into the within-subject and between-subject components for each day of testing. The results indicate that the human operator adopts a more consistent signal processing path as he learns the task, adopts a more uniform control strategy for the more difficult of the two experiments, and has an inherent variability of gain on which training has little effect. Author

N70-30885*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN INVESTIGATION INTO PURSUIT TRACKING IN THE PRESENCE OF A DISTURBANCE SIGNAL
L. D. Reid *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 129 169 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The description of man as a servo control element while performing manual tracking tasks is discussed. Most of the theory concerning the man/machine interaction has been developed for the compensatory tracking task with recent efforts being directed towards the expansion of the present theory to cover the more complex situations of pursuit tracking and multiple loop tasks. The measurement of pilot describing functions in a pursuit tracking task with system disturbances when the input power spectra are continuous in nature is considered. In this program the rms levels of the primary input and the system disturbance are the same. Author

N70-30886*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MODEL FOR HUMAN CONTROLLER REMNANT
William H. Levison, Sheldon Baron, and David L. Kleinman *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 171 198 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A model for human controller remnant is postulated in which remnant is considered to arise from an equivalent observation noise vector whose components are linearly independent white noise processes. Extensive analysis of data obtained from simple manual control systems verifies that this model structure holds over a wide range of input amplitudes and bandwidths, vehicle dynamics, and display locations. When the display is viewed foveally, the component noise processes scale with signal variance. This scale factor is independent of input parameters and of vehicle dynamics. Author

N70-30887*# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN INVESTIGATION INTO SOME ASPECTS OF THE HUMAN OPERATOR DESCRIBING FUNCTION WHILE CONTROLLING A SINGLE DEGREE OF FREEDOM

M. Gordon-Smith *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 203-240 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

A single axis, random forcing function, compensatory display tracking task was used to investigate the effect of the manipulator on the remnant portion of the human operator's output. Pressure and free-moving manipulators were used with rate control vehicle dynamics and filtered white noise forcing functions similar in spectral shape to the STI inputs. Data is presented which shows the effect of the manipulator and forcing function on the system performance, the human operator describing function, and the remnant. Author

N70-30888*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF DISPLAY GAIN ON HUMAN OPERATOR INFORMATION PROCESSING RATE IN A RATE CONTROL TRACKING TASK
Daniel L. Baty *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 243-262 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

A single axis rate control tracking experiment was conducted to determine the sensitivity of transinformation (information processing rate in bits/sec) to display gain, display type (pursuit or compensatory), and forcing function bandwidth. Four other performance measures were also derived: relative error, relative noiseless error, relative remnant, and system open-loop crossover frequency. It is shown that human information processing rates increase to a maximum and then decrease as a function of both display gain and forcing function bandwidth. In general, little difference in transinformation performance is noted between pursuit and compensatory displays. Author

N70-30889*# Technische Univ., Berlin (West Germany).
ROTATION OF VISUAL REFERENCE SYSTEMS AND ITS INFLUENCE ON CONTROL QUALITY
R. Bernotat *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 263-270 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Electronic displays pose large human engineering possibilities and, at the same time, new problems. One special aspect is the rotation of the display reference system. The human operator is unable to compensate for rotation. As a result tracking errors increase considerably at 90 deg and 270 deg rotation angles. An action-display indicating the stick signal to the control system compensates completely for the rotation effect. Author

N70-30890*# Massachusetts Inst. of Tech., Cambridge.
THREE DISPLAY TECHNIQUES AT THE MAN VEHICLE LABORATORY
Laurence R. Young, Charles M. Oman, Robert M. Vircks, Noel A. J. Van Houtte, and Gordon G. Kemp *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 271-284 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Three display techniques designed to reduce human uncertainty about his spatial orientation are presented. A 3-D display system is described in which a simple computer-generated CRT, contact analog system is controlled by movement of the observer's head, as well as by vehicle motion. A prototype VTOL guidance and control display is described. All attitude and guidance cues are presented in an integrated horizontal situation display in which pitch and roll angles appear as vehicle axis projections, and predictive display of attitude and position is used. An anti-vertigo research display is described in which visual-vestibular conflict is reduced by driving a rotating visual field at rates determined by a mathematical model for vestibular function. Author

N70-30891*# Stanford Research Inst., Menlo Park, Calif.
APPLICATIONS OF TACTILE DISPLAYS FOR PILOT CUING
John W. Hill, James C. Bliss, and Kenneth W. Gardiner *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 285-290 refs (See N70-30877 16-05)
(Contract F33615-68-C-1435)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Several vibrator, air jet, and moving button tactile displays were evaluated as cuing aids for pilot training. The best displays, as determined by tracking performance, were built into a GAT-1 trainer. The displays were further evaluated for their ability to help pilots control the trainer in some flight simulation tracking tasks. Author

N70-30892*# Illinois Univ., Urbana.
STEP TRACKING: IN WHAT SENSE IS THIS OPTIMAL?
Gyan C. Agarwal and Gerald L. Gottlieb *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 293-305 refs (See N70-30877 16-05)
(Grant NIH 1436-03)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Step tracking experiments were conducted to determine whether the human motor system behaves as a bang-bang servo. The studies show that in only one case of isotonic unpredictable tracking in transition neutral-dorsiflexed position is there a bang-bang characteristic of the system. The predominant control law indicated by the experiments is a unilateral activation of the appropriate muscle with some lead compensation. The antagonist muscle is turned off and not used as an active brake in the action, with one exception. Author

N70-30893*# Lear Siegler, Inc., Santa Monica, Calif.
AN EVALUATION OF A PILOT MODEL BASED ON KALMAN FILTERING AND OPTIMAL CONTROL
Rodney D. Wierenga *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 307-341 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

A pilot model based on Kalman filtering and optimal control is given which because of its structure provides for estimation of the plant state variables, the forcing functions, the time delay, and the neuromuscular lag. The inverse filter and control problem is considered where the noise and cost function parameters are found that yield a frequency response which is in close agreement with that found experimentally. A good correspondence with sine wave tracking is shown including eyes closed tracking. In addition, measurement noise and time delay are shown to account for the differences in frequency response caused by two vastly different displays in a tracking task and provide insight into possible ways of evaluating displays. Author

N70-30894*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN OPTIMAL CONTROL MODEL OF HUMAN BEHAVIOR
David L. Kleinman, Sheldon Baron, and William H. Levison *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 343-365 refs (See N70-30877 16-05)
(Contract NAS12-104)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Optimal control and estimation theory are applied to problems in manual control. By assuming that the human is optimal in some sense, a model is developed for human operator behavior which is capable of accurately predicting task performance, describing functions, and all power spectra. The model is described in detail and its application is made to three basic compensatory tracking tasks. Author

N70-30896*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
APPLICATION OF OPTIMAL CONTROL THEORY TO PREDICTION OF HUMAN PERFORMANCE IN A COMPLEX

TASK

Sheldon Baron, David L. Kleinman, Duncan C. Miller, William H. Levison, and Jerome I. Elkind *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 367–387 refs (See N70-30877 16-05)
(Contract F33615-68-C-1192)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

An optimal control model of the human operator is used to analyze a manual control task involving the control of longitudinal position of a hovering XV-5A aircraft. It is shown that the model can reproduce the essential characteristics of pilots performing this task as well as system performance scores. In addition, the same optimization framework is used to predict visual scanning parameters. Author

N70-30896*# Systems Technology, Inc., Hawthorne, Calif.
TRACKING QUASI-PREDICTABLE DISPLAYS SUBJECTIVE PREDICTABILITY GRADATIONS, PILOT MODELS FOR PERIODIC AND NARROWBAND INPUTS

R. E. Magdaleno, H. R. Jex, and W. A. Johnson *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 391–428 refs (See N70-30877 16-05)
(Contract NAS2-3746)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Tracking displays often present signals which are quasi-predictable from low damped vehicle modes, ship motions, etc. The practical dimensions of subjective display predictability are reviewed, and an adaptive human operator model is developed, based on the successive organization of perception theory of skill and on optimal signal prediction. Analysis of this model reveals new parameters for characterizing the subjective predictability and display performance with narrowbend processes. The model explains a number of past and present experimental results. Author

N70-30897*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
DECISION PROCESSES IN THE ADAPTIVE BEHAVIOR OF HUMAN CONTROLLERS

Anil V. Phatak (MIT, Cambridge) and George A. Bekey *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 429–459 refs (See N70-30877 16-05)
(Grant NGR-05-018-022)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

The development of a decision algorithm which simulates the rapid adaptive behavior of human controllers following sudden changes in plant dynamics is discussed. The control of a VTOL aircraft in hover following failure of the stability augmentation system is used as a specific example. The decision algorithm is based on the assumption that the human controller recognizes certain pattern features in the error-error rate phase plane. Experimental data, obtained from pilots facing four possible alternatives following the time of failure, are presented. The proposed decision algorithm is developed and digital simulation results are discussed. A theoretical justification for the algorithm based on statistical decision theory is presented. Author

N70-30898*# National Aeronautics and Space Administration, Washington, D.C.
MOTION SCALING ON ONE- AND TWO-AXIS COMPENSATORY CONTROL TASKS

Hugh P. Bergeron *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 463–470 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Tests consisting of one- and two-axis closed-loop tracking tasks, with and without motion, were made to define areas where motion cues are beneficial. Little or no difference in the error measurements was observed in the single-axis motion/no motion runs. Similar results were obtained when comparing two single-axis tests with different pitch orientation. The two-axis tests, which consisted of pitch and yaw and pitch and roll, did produce a difference in the error measurements in the motion/no motion comparisons. A decrease in normalized tracking error and an increase in the closed-loop system frequency was observed when motion was added. Tests were also run in pitch and yaw only, in which the scale of the motion input was reduced. The tests were performed by the subject in sequence starting with no motion all the way to full motion and back down to no motion. Each motion scale condition (none, 1/16, 1/8/ 1/4, 1/2, and full) constituted a test. The normalized tracking error remained constant for full, 1/2, and 1/4 motion scaling, but increased with a further reduction in motion scaling. Author

N70-30899*# Michigan Univ., Ann Arbor.
SUBJECTIVE SCALING OF SPRINGS, SHOCK ABSORBERS AND FLY WHEELS

Richard Pew and J. David Chananie *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 471–481 refs (See N70-30877 16-05)
(Contract NASr-54-(06))
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Twenty-four subjects judged the relative stiffness of springs, resistance of viscous dampers, and massiveness of inertias produced by a variable dynamics control stick. Perceived massiveness was found to be nonlinearly related to physical inertia. However, the presence of substantial damping tends to reduce sensitivity to massiveness and vice versa. Author

N70-30900*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HUMAN PERFORMANCE IN TIME-OPTIMAL STATE REGULATION TASKS

Duncan C. Miller *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 483–519 refs (See N70-30877 16-05)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

Three subjects were thoroughly trained in the time-optimal state regulation of two second-order systems with several types of displays. The subjects were required to bring the state of the controlled system from a series of arbitrary initial conditions to rest at a zero reference state in minimum time by manipulating a control switch. The statistical distributions of the subjects' switching errors were modeled in terms of the sensory judgments and decisions required by the task. Author

N70-30901*# Illinois Univ., Urbana.
MATHEMATICAL DEVELOPMENT AND SOLUTION OF A PHYSICAL MODEL FOR MUSCULAR CONTRACTILE ELEMENTS

Julia T. Apter and William W. Graessley (Northwestern Univ.) *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 523–539 refs (See N70-30877 16-05)
(Grants PHS-GM-14659; PHS-HE-05808; PHS-CA-06475)
Avail: CFSTI HC $10.00/MF $0.65 CSCL 05E

A self-consistent model based on valid physical and chemical laws known to govern the viscoelastic behavior of polymeric materials was developed to be also consistent with muscular behavior. Exposure of the model to various perturbations like stretch loading, chemical reactions, or diffusion of ions replicated events known to take place during stretch, loading, and stimulation of muscle, whether smooth or striated. The equations of motion of the model so perturbed were solved with an analog computer which generated stress, strain, and strain rate curves for the model. The curves closely resembled real shortening velocity-time curves, force-velocity curves, isometric tension development, and other muscular responses. Therefore it was possible to obtain initial estimates of model parameters from real muscular behavior. The results show some details of real muscular behavior previously not appreciated, like phase gain-angle and elastic modulus enhancement

at critical sinusoidal strain frequencies. The general nature of the model makes it possible to formalize more complex perturbations and to quantify a wide range of muscular behavior. Author

N70-30902*# Illinois Univ., Urbana.
MUSCLE SPINDLE MODELS: MULTIPLE INPUT-MULTIPLE OUTPUT SIMULATIONS
Gerald L. Gottlieb and Gyan C. Agarwal *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 541-558 refs (See N70-30879 16-05)
(Grant NIH 1436-03)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A mathematical model is developed to describe simulations of a linear, lumped-parameter mechanical model of the muscle spindle as a neurally controlled transducer of stretch and the requirements such a model places on control mechanisms are discussed. The control exerted by the efferent nervous system on the dynamic and static behavior of the muscles is discussed. R.B.

N70-30903*# Illinois Univ., Urbana.
SOME ASPECTS OF HUMAN POSTURAL REGULATION
Gyan C. Agarwal, Gerald L. Gottlieb, and Lawrence Stark (California Univ., Berkeley) *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 559-579 refs (See N70-30877 16-05)
(Grant NIH 1436-03)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Two antagonistic muscular systems were studied, one of which rotates the forearm (wrist rotation) and the other flexes the ankle joint. The anatomical components of the stretch reflex include a physiological transducer, called the spindle receptor, which senses the length and the rate of change of length of a muscle and converts this information into a neural signal, the motor neutrons which combine the feedback signal from spindles with other control signals, and the muscle together with its load which is the system being controlled. R.B.

N70-30904*# California Univ., Los Angeles.
A FORMAL MODEL FOR ARM MOTION DURING TARGET APPROACH
J. W. Aldrich, J. Lyman, and H. Stassen *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 581-608 refs (See N70-30877 16-05)
(Grants HEW-RD-2904-M-69; V100SP-9779)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

One of the critical problems in the control of remote manipulators and prostheses is the ability of the human operator to control a multiple degree of freedom device effectively with a minimum number of controllers. For more than three degrees of freedom, effective control by using one controller axis for each degree of freedom becomes excessively difficult. A study of the fine structure of limb outputs in a multiple degree-of-freedom task was undertaken to analyze actual arm motion in a given multiple degree-of-freedom task and to develop a formal model for motion about each degree of freedom in a multiple degree-of-freedom voluntary task. Author

N70-30905*# Massachusetts Inst. of Tech., Cambridge.
CONTRIBUTIONS OF ROLL AND YAW MOTION CUES IN MANUAL CONTROL
L. R. Young and P. B. Dinsdale *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 609-613 (See N70-30877 16-05)
Avail: CFSTI HC$10.00/ MF$0.65 CSCL 05E

Previous communications concerning the effects of roll motion cues on pilot characteristics emphasized the increase in low frequency gain and the phase lead contributed at higher frequencies. To determine the relative contributions of semicircular canal and otolith responses, experiments were performed in yaw and roll control of a K/s squared vehicle on a moving base rotation simulator. Comparison of human operator describing functions shows that rotation with respect to the g vector (roll) leads to higher gain than rotation in a horizontal plane, although no significant difference in phase lag appears. Author

N70-30906*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FOUR-AXIS COMPENSATORY SYSTEMS WITH SEPARATED DISPLAYS AND CONTROLS
William H. Levison and Jerome I. Elkind *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 617-636 refs (See N70-30877 16-05)
(Contract NAS2-3080)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A current experimental study of multivariable manual control systems is reviewed. Results are presented from a complementary set of single-axis and multi-axis experiments. Single-axis data show that mean-squared error scores, controller describing functions, and observation noise spectra vary in a predictable way with viewing conditions. Multi-axis tracking tasks in which visual scanning is prohibited indicate the presence of a significant amount of interference between the tasks. The scanning behavior exhibited by the subjects when tracking four axes simultaneously corresponds to the observational qualities of the various displays as revealed through the single-axis experiments. Author

N70-30907*# Systems Technology, Inc., Hawthorne, Calif.
A THEORY FOR THE HUMAN OPERATOR'S REMNANT IN MULTILOOP DISPLAY-CONTROL TASKS
W. F. Clement *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 637-654 refs (See N70-30877 16-05)
(Contract N00014-68-C-0443)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The theory comprises stochastic finite-dwell sampling among displays with continuous control output based on intersample reconstruction theory. Random sampling remnant theory introduces the notion of stability in the mean-square sense in the operator's closed-loop tracking performance. A related regression of adopted crossover frequency is shown to be sensitive to the controller's sampling remnant. Foveal or parafoveal finite dwell sampling and intersample control output reconstruction suppress sampling remnant. A suppressed remnant will enable the operator to adopt ratios of sampling-to-crossover frequency more nearly approaching the lower bound predicted by the generalized sampling theorem. Two examples illustrate the practical application of the theory to displays for manual control. The influences of finite dwell and intersample reconstruction suggest that sampling remnant may offer a powerful practical measure for trading off the number and types of displays in a multiloop control situation. Author

N70-30908*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
APPLICATION OF PILOT MODELS TO DISPLAY DESIGN SOME BASIC EXPERIMENTS
R. O. Anderson *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 655-659 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A brief summary of experiments using simple controlled elements in primary tracking tasks and two forms of secondary task is presented. The results, in the form of eye movement data, task performance, etc. are compared with one existing theory, and a number of possibilities for future work are presented. The results are also applicable for workload definition. Author

N70-30909*# Ohio State Univ., Columbus.
DESCRIBING FUNCTION MODELS OF A DRIVER-AID SYSTEM FOR CAR FOLLOWING
Ronald G. Rule and Robert E. Fenton *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 663-684 refs Sponsored by the Ohio Dept. of Highways (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Excellent car-following performance can be obtained by aiding the driver, this has previously resulted in asymptotic instability. A control stock with a built-in kinesthetic-tactile display aid for the driver was tested in a car-following situation, and describing function models of the resulting driver-vehicle system were calculated. Asymptotic stability was obtained by using control compensation, which also resulted in improved longitudinal handling qualities. Author

N70-30910*# Massachusetts Inst. of Tech., Cambridge.
RESOLVED MOTION RATE CONTROL OF RESOLVED MANIPULATORS AND HUMAN PROSTHESES
Daniel E. Whitney *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 685-696 refs Sponsored in part by Dept. of Health, Educ. and Welfare (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

The kinematics of remote manipulators and human prostheses is analyzed for the purpose of deriving resolved motion rate control. That is, the operator is enabled to call for the desired hand motion directly along axes relevant to the the task environment. The approach suggests solutions to problems of coordination, motion under tasks constraints, and appreciation of forces encountered by the controlled hand. Author

N70-30911*# Boeing Co., Seattle, Wash.
EVALUATION OF A NEW AIRCRAFT CONTROLLER CONCEPT FOR THE SST
John De Shon Warner *In* NASA, Washington Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 697-708 refs (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

A primary controller design which has the purpose of increasing the visible area on the SST instrument panel is reported. Results from a preliminary fixed base SST simulator study show that the concept is feasible from a manual control standpoint, but that more work is required to define optimum force-feel characteristics and the influence of motion. Author

N70-30912*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME APOLLO MIDCOURSE MANUAL CONTROL SIMULATION INNOVATIONS
Dexter C. Sederstrom, J. Robert Peterson, Derril B. Pratt, and O. Herbert Lindquist *In its* Fifth Ann. NASA-Univ. Conf. on Manual Control 1970 p 709-713 (See N70-30877 16-05)
Avail: CFSTI HC$10.00/MF$0.65 CSCL 05E

Analysis performed on the backup stabilization and control system for the Apollo project included man-in-the-loop studies for the service module reaction control system. The primary objectives were to establish procedures and techniques both for standard operation and in the event of failures in some of the reaction jets and to estimate the propellant consumption. The test setup included a 140 amplifier analog simulation, an electronic reaction jet breadboard, and a cockpit mockup. Three findings discussed include fast-time operation, maneuvers with failed reaction jets, and use of product-of-rate terms in the equations of motion. Author

N70-30933*# Whirlpool Corp., St. Joseph, Mich.
FEEDING SYSTEM DESIGN FOR ADVANCED ORBITAL FACILITIES Final Report
George Boswinkle [1970] 136 p refs
(Contract NAS9-9780)
(NASA-CR-108484) Avail: CFSTI

A conceptual design is defined for a feeding system for 100 men in orbiting space facilities for periods up to 90 days, providing food which maintains nutritional and psychological function in the environment of space. The areas of food preparation, food service, consumption, and cleanup were studied and optimal recommendations are presented. This plan supplies appetizing food approaching the theoretical ideal of earth-based meals. Beside supplying adequate nutrition, this system should contribute to mission accomplishment by greatly improving the morale of the crew. Recognizing the difficulties involved in preparing the varieties of foods required by such a system from basic ingredients under conditions of weightlessness, the recommended feeding system relies heavily on frozen, fully-prepared foods which need only be thawed and heated in one operation to make them ready for the table. Author

N70-30941# Pillsbury Mills, Inc., Minneapolis Minn.
MAXIMUM VARIETY FROM FEEDING UNIT OF LOW WEIGHT AND BULK
James Blodgett Natick, Mass. Army Natick Labs. Nov. 1969 76 p refs
(Contract DAAG17-68-C-0148)
(AD-702959; TR-70-29-FL; FL-103) Avail: CFSTI CSCL 6/8

A project was originated to: (1) improve organoleptic acceptability and performance of meal items, (2) develop 5 dual function food bars and (3) develop a coating material(s) and methods of application to prevent fragmentation of the components. Information is presented for the preparation of 7 improved food bars and 11 improved adjunct cubes which, when combined in defined combinations, yield 32 familiar meal items. Five dual function food bars were also prepared. Dual function bars may be consumed as is or hydrated to yield a familiar food item. Two coatings were prepared which, when applied to the food bars and adjunct cubes, prevent attrition and fragmentation during handling. Meal items prepared from the above coated components which had been stored for four months at 38 degrees C. in N2 filled cans were found acceptable when evaluated by a 30-man panel. Hedonic ratings for the prepared meal items before and after storage with data on microbiological and moisture changes during storage and data to indicate coating effectiveness are also given. Author (TAB)

N70-30967*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL INVESTIGATION ON MODELING DIFFERENT TYPES OF NEURONS
V. I. Kiy et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 107-114 (See N70-30951 16-04)
Avail: CFSTI CSCL 06D

A mathematical model of a system, is proposed as an example of the electrical activity of vestibular neurons. The model makes it possible to overcome many methodological difficulties of electrophysiological experiments, and to model conditions of the experiment and to introduce them as a disrupting effect. Author

N70-30978*# Techtran Corp., Glen Burnie, Md.
VESTIBULAR TRAINING OF TEST PILOTS BY PASSIVE METHODS
N. I. Popov et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 173-176 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 05I

The problem of conditioning men to rotation with transfer to an unstable platform, rocking, rotation with active tilting of the head and body, balancing, and to complex vestibular and visual stimuli is considered. An increased tolerance of man to the enumerated effects was achieved in all cases after conditioning. Author

N70-30985*# Techtran Corp., Glen Burnie, Md.
ELECTRONYSTAGMOGRAPHY AND ITS PROSPECTS
A. Ye. Kurashvili et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 204-209 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 06B

Electronystagmography is a simple and accurate method of recording eye movements. It may be used in the study of pathological states in the vestibular analyzer. It is used to establish a correlation between oculomotor nuclei and vegetative centers, and also to study the interaction between the vestibular and visual analyzers. Author

N70-31050*# General Dynamics/ Convair, San Diego, Calif.
GRAVITY-SENSITIVITY ASSESSMENT CRITERIA STUDY: THE LIFE SUPPORT SYSTEM ZERO-G STUDY Final Report, Oct. 1968-Jun. 1970
Washington NASA Jun. 1970 456 p refs
(Contract NAS1-8494)
(NASA-CR-66945; GDC-DBD70-003) Avail: CFSTI CSCL 06K

Six analytical models have been developed following an analysis of some 80 life support system equipments and a laboratory experimental program has been completed. Analysis of the experimental data obtained from the test of each analytical model has shown, 1) that the approaches followed were generally sound, 2) that the experiment produced data which could be employed to improve the analytical model, and 3) that the predictive capability of the model (and computer program) has significant potential to the design of life support systems. Two sets of documentation have been initiated—one consisting of the formal documents, the other of informal documents. Author

N70-31125# National Bureau of Standards, Washington, D.C.
HUMAN ENGINEERING A CONSOLE FOR THE COMPARISON OF VOLT BOXES
P. H. Lowrie, Jr. *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 217-22 refs (See N70-31104 16-09)
Avail: SOD $4.50

The principles of human engineering are as applicable to making precise measurements as they are to the production line. Too often the human element is not given adequate consideration in the design of precise measuring equipment and as a result, accuracy declines. To reduce this source of error, a calibration console was designed in which the human engineering factors were given the same consideration as the technical requirements. In this system the console operator is considered to be a decision maker, and those functions not requiring judgment are automatically processed by the console. Most of the calculations are performed automatically by internal circuits, and the results are displayed digitally upon command. Author

N70-31331# RAND Corp., Santa Monica, Calif.
THE DELPHI METHOD 4: EFFECT OF PERCENTILE FEEDBACK AND FEED-IN OF RELEVANT FACTS
N. Dalkey, B. Brown, and S. Cochran Mar. 1970 49 p refs
(Contract F44620-67-C-0045)
(AD-702790; RM-6118-PR) Avail: CFSTI CSCL 5/10

Two variations in the form of feedback in Delphi exercises are investigated: the effect of feeding back the percentile location of an individuals answer in the group distribution and the effect of presenting the respondent with a single additional relevant fact. Experiments were set up to compare the improvement in responses to 20 general information type questions between two groups that received different feedback. Author (TAB)

N70-31426# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
THIRD WORKING SESSION ON DECOMPRESSION DISEASES [3. ARBEITSTAGUNG UEBER DRUCKFALLKRANKHEITEN]
O. Wuensche Sep. 1969 176 p In GERMAN Conf. held at Bad Godesberg, West Germany, 18-19 Apr. 1968
(DLR-FB-69-58; DVL-886) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

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N70-31428# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
THE APPLICATION OF THE COMPRESSED AIR METHOD IN DEPTH AND UNDERWATER TUNNEL CONSTRUCTION IN COMPARISON WITH OTHER CONSTRUCTION METHODS [DIE ANWENDUNG DES DRUCKLUFTVERFAHRENS BEI TIEFGRUENDUNGEN UND UNTERWASSERTUNNELN IM VERGLEICH MIT ANDEREN BAUWEISEN]
F. Apel *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 19-31 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Technical aspects of preventing decompression sickness in depth foundation and tunnel construction workers are considered. This type of civil engineering method employs compressed air caissons to lower ground water levels during construction of bridge piles, etc., and thus keeps the workmen under increased atmospheric pressure for some time. It is shown that a caisson pressure of up

to 1.3 atm constitutes a safe working environment for a healthy construction worker and does not pose any problems during normal decompression procedures. Transl. by G.G.

N70-31430# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

DIFFERENCES AND SIMILARITIES OF DIVING AND CAISSON WORK [TAUCHEN UND CAISSONARBEIT, UNTERSCHIEDE UND GEMEINSAMKEIT]

K. Seemann *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 51-58 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Physiological working conditions and safe decompression procedures in diving and caisson work are compared by their induced medical indices and treatment methods. It is shown that the selection of divers requires more restricted medical guidelines and imposes certain age limits than comparative selection of caisson workers. Although both professions experience pressure fluctuations, only divers are sometimes subjected to pressure drops in lungs and other body cavities that cause sudden traumas. Poisoning through increased partial pressure of the breathing gases and caisson sickness with overexpansion of lungs and aseptic bone necroses are also discussed. Prophylactic and therapeutic treatments for divers vary in respective decompression and recompression times with oxygen inhalation and depend on the medical diagnosis. Transl. by G.G.

N70-31431# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

DANGERS OF WELDING AND CUTTING IN COMPRESSED AIR COMPARTMENTS [GEFAHREN BEI SCHWEISS- UND SCHNEIDARBEITEN IN RAEUMEN UNTER DRUCKLUFT]

K. R. Doerr *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 59-69 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Personnel injuries and property damage during work with compressed air depend to a large extent on the training of the personnel and the type of combustible gas, pressure-relieve valve, and welding and cutting equipment used. Work with acetylene gas includes the danger of a difficult to recognize decomposition inside the pressurized bottle with subsequent sudden explosion. The explosive region of hydrogen is between 4 to 75 volume percent in a normal atmosphere and increases up to 96 volume percent in a pure oxygen atmosphere. Explosive sensitivity of pressurized acetylene starts already at 2 atm and a solution in acetone is recommended for bottling. A liquid gas mixture consisting mainly of propane and butane is given commercial preference because it is easily transportable at low temperatures and pressures; however, unnoticeable leakage and mixing with oxygen can induce asphyxiation and explosion, respectively. Transl. by G.G.

N70-31432# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

SAFETY TECHNOLOGY ASPECTS OF OXYGEN INHALATION IN HIGH PRESSURE LOCKS [SICHERHEITSTECHNISCHE BETRACHTUNGEN ZUR SAUERSTOFFATMUNG IN UEBERDRUCKSCHLEUSEN]

H. D. Fust *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 71-82 ref In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

The use of pure oxygen in compressed air chambers increases the danger of sudden explosions markedly; ignition probabilities for most objects jump about a thousand times at pressures from one to three atmospheres when compared with a normal atmosphere. Clothing materials with a potential spark energy of 0.5 millijoule are sufficient to trigger flames on clothing surfaces that spread at about 50 cm per second. The installation of oxygen concentration measuring and warning systems in recompression and caisson construction chambers with oxygen inhalation is advisable; recommended is a continuous ventilation of exhaust gases with complete recirculation of the chamber atmosphere. Another method described uses intermittent attendance in lower pressure rooms to break the eight hour shift of caisson workers in compressed atmospheres and to prevent toxic effects of the high partial oxygen pressure. Transl. by G.G.

N70-31433# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

SAFETY OF DECOMPRESSION LOCKS WITH OXYGEN INHALATION [GEFAHRLOSIGKEIT DER AUSSCHLEUSUNG MIT SAUERSTOFFATMUNG]

G. Scheele *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 83-90 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Emphasized is the efficient application of on and off oxygen inhalation during decompression that prevents oxygen intoxication at high atmospheric pressures. This hyperbaric oxygen therapy is most beneficial in the treatment of gas edema patients; even severe cases with extended infections improve fast and heal well after repeated decompression with oxygen inhalation over a period of three days. Good results are also obtained with this treatment combination in carbon monoxide poisoning and open heart surgery. Further applications in coronary insufficiency, insufficient peripheral arterial blood flow, arterial sclerosis, and blockage of brain vessels are indicated. Brief inhalations of pure oxygen two times daily are only used in the treatment of chronic bronchitic syndromes with secondary emphysema and respiratory insufficiency. It is concluded that high pressure oxygen inhalation therapy is of utmost importance during decompression from caissons and for the treatment of decompression sickness. Transl. by G.G.

N70-31435# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

ASPECTS OF THE PROPOSED DRAFT FOR REGULATION OF WORK IN COMPRESSED AIR [ASPEKTE ZUM NEUENTWURF VERORDNUNG FUER ARBEITEN IN DRUCKLUFT]

O. Wuensche *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 111-118 In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Principles of entrance and discharge, duration of work, and safe pressure increases for working in a compressed air environment are described and proposed are new standards that use higher working pressures with corresponding prolongation of decompression step times. Developed conditions are kept flexible and rational for practical purposes and propose the elimination of the old limitation to 3.5 atm pressure. Decompression chambers of about 2.3 to 5.5 atm pressure have to be present at working sites that require an environmental pressure of about 2.3 atm. Working pressures of about 1.3 to 2.3 atm require only decompression chamber pressures of about 3.0 atm. Transl. by G.G.

N70-31436# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

STATEMENT OF EMPLOYERS IN REGARD TO THE NEW REGULATION DRAFT [STELLUNGNAHME DER UNTERNEHMERSCHAFT ZUM NEUEN VERORDNUNGSENTWURF]

H. Baumann *In its* 3rd Working Session on Decompression

Diseases Sep. 1969 p 119–123 In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Considered is a new draft for regulating work under compressed atmospheres that contains detailed instructions for extended medical supervision and elaborates on decompression step times in high pressure environments. The proposed new regulation contains a requirement that compressed air workers are retained at construction sites for two hours after their shift ends so that incidents of decompression sickness are minimized even at working conditions in 32 meter depth. Also recommended is the inhalation of oxygen during decompression procedures. Transl. by G.G.

N70-31438# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
PROBLEMS OF DECOMPRESSION [PROBLEME DER DEKOMPRESSION]
J. N. Meesters *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 133–143 refs In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Prolonged step times during therapeutic decompression with oxygen inhalation for compressed air workers in civil engineering projects prevent the formation of bone necroses. New regulations prescribe a pressure drop of 60% two minutes from the original pressure in order to attain tissue saturation at 1.0 atm for 18 lb/sq inch. High pressure working time durations are also reduced and work even prohibited if medical contraindications are observed during lung X-rays, sinutide or otide conditions, heart and circulatory disturbances, and adipositas. Included are decompression tables that constitute Dutch regulations from the year 1961. Transl. by G.G.

N70-31439# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.
MEDICAL OBSERVATIONS AT THE TUNNEL CONSTRUCTION SITE KAROLINEN STREET, HAMBURG [AERZTLICHE ERFAHRUNGEN AUF DER TUNNELBAUSTELLE KAROLINENSTRASSE HAMBURG]
D. Niederstadt and R. Pott *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 145–160 refs In GERMAN (See N70-31426 16-05)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38.70 DM

Considered are the following aspects of compressed air workers in tunnel construction: (1) organization of medical supervision; (2) survey of technical data; (3) employment examinations and reasons for disqualifications; (4) decompression chamber periods; (5) first aid stations; (6) compressed air sicknesses and their treatments; and (7) some considerations of aetiology and pathophysiology. The observation of relative numerous compression effects in workers under relative low pressure working conditions are attributed to additional effects of body vibrations and noise which hinder nitrogen solubility in bradytrophic tissues. Transl. by G.G.

N70-31488# IIT Research Inst., Chicago, Ill.
VISUAL PERFORMANCE WITH SIMULATED FLARELIGHT IN ARTIFICIAL CLOUDS Final Report, Feb. – Aug. 1969
Sidney Katz, Paul K. Ase, Elliot Raisen, and Robert L. Hilgendorf Jan. 1970 83 p refs
(Contract F33615-69-C-1386)
(AD-704125; AMRL-TR-69-121; IITRI-C6173-1) Avail: CFSTI CSCL 19/1

The report describes a laboratory procedure for studying the effects of fog or mist on visual acuity under conditions of night illumination. Author (TAB)

N70-31498# Mitre Corp., Bedford, Mass.
STUDIES OF DISPLAY SYMBOL LEGIBILITY. 22: THE RELATIVE LEGIBILITY OF FOUR SYMBOL SETS MADE WITH A FIVE BY SEVEN MATRIX
Donald A. Shurtleff Bedford, Mass. ESD Mar. 1970 41 p refs
(Contract F19628-68-C-0365)
(AD-704136; MTR-833; ESD-TR-70-26) Avail: CFSTI CSCL 5/5

Legibility comparisons were made among four 5 x 7 dot fonts. The four symbol fonts were shown under nearly optimal viewing conditions to one group of operators and under degraded viewing conditions to a second group of operators. The results showed that no one symbol set was significantly superior in legibility to any of the other sets. It was concluded that new symbols designs are needed to improve the legibility of present 5 x 7 dot symbol sets. Author (TAB)

N70-31625# Naval Aerospace Medical Inst., Pensacola, Fla.
THE SEMIAUTOMATED TEST SYSTEM: A TOOL FOR STANDARDIZED PERFORMANCE TESTING
H. Rudy Ramsey 5 Nov. 1969 19 p refs
(AD-702903; NAMI-1092; USARRL-70-8) Avail: CFSTI CSCL 5/9

Performance tests which are truly standardized must be administered in a way that will minimize variation due to operator intervention and errors. Through such technological developments as low-cost digital computers and digital logic modules, automatic test administration without restriction of test content has become possible. A semiautomated test system (SATS) which incorporates programmable digital logic modules for control has been developed to allow an experimental psychologist, unassisted and with a minimum of special training, to set up and modify tests or experiments; thus, it is especially useful for exploratory studies. The structure of the SATS is described and an example is presented to clarify the operations involved in its use. Author (TAB)

N70-31626# Ohio State Univ., Research Foundation, Columbus.
EDUCATIONAL PROGRAM FOR SCIENTISTS AND ENGINEERS AT WRIGHT-PATTERSON AIR FORCE BASE, 1 OCTOBER 1967 – 31 DECEMBER 1968
Herman R. Weed, Marion L. Smith, and Richard D. Frasher Jan. 1970 193 p
(Contract F33615-68-C-1056)
(AD-702867; AFHRL-TR-69-9) Avail: CFSTI CSCL 5/9

This contract, a pilot study of Project Innovate Task C, calls for development of programs to update Air Force scientists, engineers, senior technicians, and managers of science and engineering, both military and civilian, who work in research and development at Wright-Patterson Air Force Base. The programs shall provide current knowledge and information to professional employees to help them stay abreast of rapidly advancing technology in their own and related specialties. Phase I reports identification of needs and available training programs. Needs in continuing education were assessed from: existing personnel and training records, questionnaires distributed to all appropriate personnel at WPAFB, personal interviews with five percent of engineers and scientists, and group interviews with management personnel of all laboratories and divisions. While present level of participation in educational and training programs is sizeable, there is a clear need for greatly expanded educational programs. The nature of these needs and suggested methods for meeting them at WPAFB is described. The Phase II lists recommendations for educational programs to meet the continuing education needs at Wright-Patterson Air Force Base and suggests the administrative organization for implementing these programs. Author (TAB)

N70-31695# California Univ., Los Angeles. Biotechnology Lab.
THE APPLICATION OF A THEORETICAL LEARNING MODEL TO A REMOTE HANDLING CONTROL SYSTEM

Amos Freedy, Frederick Hull, and John Lyman Jan. 1970 107 p refs
(Grant DA-ARO(D)-31-124-G1035)
(AD-703938; AROD-8048-1-RT; Rept-70-7; TR-47) Avail: CFSTI CSCL 6/2

The report introduces the concept of adaptive aiding as a means of improving performance in remote handling, and describes the development, realization and experimental evaluation of a system based on this concept. The system incorporates an automaton that is able to supplement the operators control of a powered manipulator arm as well as act as a parallel controller. The operator positions the manipulator in three dimensions by means of joystick control; a foot-pedal opens and closes the manipulator claw. The behavior of the automaton is established through a process of learning -- observing the human operators control actions relative to the environment and the manipulator output, and developing a decisionmaking policy. Initially, the manipulator is totally controlled by the operator, while the automaton acts as a passive observer. As operation continues, behavior patterns are acquired by the automaton, and gradually it is transformed from a passive observer to an active controller. Author (TAB)

N70-31781*# North American Rockwell Corp., Downey, Calif. Space Div.
LUNAR ESCAPE SYSTEMS (LESS) FEASIBILITY STUDY. VOLUME 1: SUMMARY REPORT
J. O. Matzenauer Washington Jun. 1970 25 p refs
(Contract NAS1-8923)
(NASA-CR-1619; SD-69-598-1) Avail: CFSTI CSCL 06K

The results of a feasibility study of lunar emergency escape-to-orbit systems are summarized. The mission of the lunar emergency escape-to-orbit system (LESS) is to provide a means for the crew of the lunar module (LM) or extended LM (ELM) to escape from the surface in the event that the LM/ELM ascent stage is unsafe or unable to take off into orbit. The LESS role is to carry the two astronauts to the CSM in orbit within three to four hours. Development of the LESS vehicle will provide increased crew safety margins by covering possible failures of the critical single-engined LM/ELM ascent stage. Author

N70-31802*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: WATER RECOVERY SYSTEMS
John R. Tole Washington NASA Jun. 1970 59 p refs
(Grant NGR-22-009-312)
(NASA-CR-1629) Avail: CFSTI CSCL 06K

One of the vital spacecraft life support systems is that used to supply water. Short duration missions allow storage of sufficient water, but for long duration missions, the weight of such a supply becomes unacceptable. This paper reviews techniques for recovering potable drinking and wash water from spacecraft waste water. Emphasis is placed on problem areas which exist in such recovery and which may be suitable topics for university type research. Areas covered include nature of waste waters which might be processed, potability requirements and monitoring techniques, existing and possible future recovery techniques, means of selecting a suitable technique from a number of different types, and problems of a fringe nature such as means of monitoring body mass to keep track of human water exchange. An attempt is made to stimulate new ideas based on present knowledge. Author

N70-31811# Melpar, Inc., Falls Church, Va.
STUDY OF ADAPTIVE MATHEMATICAL MODELS FOR DERIVING AUTOMATED PILOT PERFORMANCE MEASUREMENT TECHNIQUES. VOLUME 2: APPENDICES Final Report, Jan. 1968 -Jan. 1969
E. H. Connelly, A. R. Schulsr, and Patricia A. Knoop (Human Resources Lab., AFSC) Oct. 1969 580 p refs
(Contract F33615-68-C-1278)
(AD-704115; AFHRL-TR-69-7-Vol-2; Rept-8054-Vol-2) Avail: CFSTI HC $10.00/MF $0.65 CSCL 5/9

The report documents research on a new approach to deriving human performance measures and criteria for use in automatically evaluating trainee performance. The ultimate application of the research is to provide methods for automatically measuring pilot performance in a flight simulator or from recorded in-flight data. An efficient method of representing performance data within a computer is described. A system of adaptive mathematical and computer models is developed to examine representative performance data corresponding to known skill-levels and to independently develop a unique method of performance evaluation. Three types of models are developed, each of which is designed to derive and use (in an adaptive performance evaluation scheme) unique types of performance measures: (1) State-transfer measures, which are based on overall trends of the performance; (2) Absolute measures, which are based on a comparison of actual performance with some reference or standard; and (3) Relative measures, which are based on relations among various performance variables. A preliminary demonstration and an evaluation of the system are made, using a simulated aircraft landing program to provide hypothetical test data. Author (TAB)

N70-31852# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
EXPERIMENTAL COMPARISON OF TRAUMA IN LATERAL (+G SUB y), REARWARD FACING (+G SUB x), AND FORWARD FACING (-G SUB x) BODY ORIENTATIONS WHEN RESTRAINED BY LAP BELT ONLY
Richard G. Snyder, Clyde C. Snow, Joseph W. Young, G. Townley Price, and Peter Hanson Jul. 1969 25 p refs
(FAA-AM-69-13) Avail: CFSTI

Twenty-four anesthetized Savannah Baboons (Papio Cynocephalus) restrained with a lap belt were subjected to a controlled series of lateral impacts at entrance velocities ranging from 36.4 ft./sec. (15g.) to 88.2 ft./sec. (44g.) 1,200 g./sec. to 5,900 g./sec. rate of onset, for total durations of 0.076 to .100 second. Sixteen lateral (+G sub y) tests were run with four forward-facing and four rearward-facing controls. Gross and microscopic autopsies were performed. Pathology was found to be significantly higher in lateral impact. Ruptured bladders and uteri, adrenal hemorrhage, and subdural and epidural hemorrhage occurred frequently. A major finding, with unexplained etiology, was marked pancreatic hemorrhage most typical of the lateral impact. Under these test conditions, both survival and injury tolerance levels were found to be lower in the lateral (+G sub y) body orientation, indicating lap belt restraint alone does not provide adequate body protection. Author

N70-31892*# Matrix Corp., Alexandria, Va. Human Factors Div.
SELECTION OF SYSTEMS TO PERFORM EXTRAVEHICULAR ACTIVITIES: MAN AND MANIPULATOR. VOLUME 1: PERFORMANCE EFFECTIVENESS EVALUATION SCHEME (PEEVS). PART B: REFERENCE DATA
Kenneth M. Mallory, Jr., Edward L. Saenger, and Thomas B. Malone 27 Apr. 1970 68 p
(Contract NAS8-24384)
(NASA-CR-102763) Avail: CFSTI CSCL 06B

Instructions are presented for using the Performance Effectiveness Evaluation Scheme (PEEVS). Reference data sheets and worksheets required to use PEEVS are also given. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-30842# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TEMPERATURE AND MATRIX EFFECTS ON THE PHOSPHORESCENCE OF AROMATIC HYDROCARBONS, JUNE - OCTOBER 1969
Peter F. Jones 31 Dec. 1969 20 p refs
(Contract F04701-69-C-0066)
(AD-702798; TR-0066(5250-20)-4; SAMSO-TR-70-75) Avail: CFSTI CSCL 7/4

A review of the literature indicates that the large temperature variations in the triplet state lifetime of aromatic hydrocarbons in fluid solvents is almost entirely due to the diffusion of adventitious impurity quenchers. Experiments with polymer matrices, which inhibit diffusion over a wide temperature range, indicate a small but finite temperature variation in the triplet state lifetimes. Considerably greater temperature effects are observed for other types of molecules. Author (TAB)

N70-30650# South Carolina Univ., Columbia.
THE CHEMISTRY OF RUTHENIUM COMPLEXES Annual Report
E. E. Mercer [1969] 20 p refs
(Contract AT(40-1)-3542)
(ORO-3542-7) Avail: CFSTI

Progress is reported for the preliminary studies of the oxidation of the blue chloride complexes of ruthenium by Fe(+3). The spectrophotometric titration at 600 nm of the blue cation using Fe(+3) as the oxidant produced a change in absorbance which only could occur if the potential difference between the Fe(+2)/Fe(+3) couple and that of the ruthenium couples was less than 0.10 v. Potentiometric titration with Ce(4) as an oxidant also added valuable information about the nature of the blue complexes. Cyclic voltammetry curves were recorded on RuCl(+2) at two different sweep rates. The appearance of two oxidation peaks corresponding to the reoxidation of RuCl(+) at the slower rate is shown. J.M.C.

N70-30767*# Brigham Young Univ., Provo, Utah.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALAKLINE SILVER ELECTRODE Quarterly Report
Eliot A. Butler and Angus U. Blackham 15 May 1970 29 p refs Prepared for JPL
(Contract NAS7-100; JPL-952268)
(NASA-CR-110430; QR-8) Avail: CFSTI CSCL 07D

CONTENTS:
1. OXIDATION OF MODEL PORE ELECTRODES p 1-13 (See N70-30768 16-06)
2. CHARGE ACCEPTANCE OF SILVER ELECTRODES p 14-25 refs (See N70-30769 16-06)

N70-30768*# Brigham Young Univ., Provo, Utah.
OXIDATION OF MODEL PORE ELECTRODES
In its Studies of Reaction Geometry in Oxidation and Reduction of the Alkaline Silver Electrode 15 May 1970 p 1-13 (See N70-30767 16-06)
Avail: CFSTI CSCL 07D

A model pore electrode of a new and larger design was constructed to facilitate the correlation of observed electrode phenomena with the corresponding section of the constant-current oxidation curve. Alternate dark and light bands were observed at the same time potential oscillations were recorded and are discussed. Qualitative descriptions of some other electrode phenomena are also given. Author

N70-30769*# Brigham Young Univ., Provo, Utah.
CHARGE ACCEPTANCE OF SILVER ELECTRODES
In its Studies of Reaction Geometry in Oxidation and Reduction of the Alkaline Silver Electrode 15 May 1970 p 14-25 refs (See N70-30767 16-06)
Avail: CFSTI CSCL 07D

Charge acceptance measurements were made for a series of potentiostatic oxidations of a silver wire electrode by the three different methods: Simpson's rule of thirds, the graphical cut and weigh method, and subsequent reduction at constant current. The results are compared and the problems observed are discussed. The same wire electrode was taken through thirty-five oxidation-reduction cycles. The increase of charge acceptance (at potentials 0.3 to 0.4 V) from about 150 mcoul/sq cm reported previously when a new wire was used for each run to about 330 mcoul/sq cm reported here probably reflects the increase in surface area of the electrode with cycling. Some preliminary experiments on the manner in which a short oxidation at one potential influences subsequent charge acceptance at a different potential are presented. Author

N70-30938# Dow Chemical Co., Midland, Mich.
PERCHLOROCARBON POLYMERS Final Report, 7 Apr. 1966 - 1 Jun. 1969
Harold E. Doorenbos Nov. 1969 77 p refs
(Contract AF 33(615)-3495)
(AD-702840; PC-1F-69; ARL-69-0191) Avail: CFSTI CSCL 7/4

The complete chlorination of dialkyl-substituted aromatics has now been achieved on a practical scale in high yield with good conversion. The use of the complex, $SO_3(+)AlCl_4(-)$, along with chlorine makes these perchlorocarbons readily available in large quantities on a laboratory scale. The condensation polymerization of the perchlorinated materials (e.g., perchloro-p-xylene, perchloro-p-bitolyl) via reductive dechlorination was carried out with a dialkyl hydrogen phosphonate in the presence of a catalytic amount of cuprous chloride. This procedure gave higher molecular weight polymers than those obtained by the stannous chloride procedure. Structural variations in the homo and copolymers resulted in solubility changes. All polymers were glassy and friable. When the soluble polymers were cured at 400C, however, insolubilization occurred and the polymers developed improved thermal stability and strength. Certain preliminary application tests showed potential uses as: (1) high temperature laminating resins; (2) extreme pressure additives for lubricating oils; (3) water-insoluble, fire-retardant, fiber-reactive materials; and (4) biologically active compounds having limited uses. Author (TAB)

N70-30939# Columbia Univ., New York. Dept. of Chemistry.
CHEMISTRY OF MOLECULES POSSESSING HIGH ENERGY CONTENT Final Technical Report, 1 Jan. 1966 - 31 Jan. 1970
Nicholas J. Turro Jan. 1970 17 p refs
(Grants AF-AFOSR-1000-66; AF-AFOSR-1381-68)
(AD-702858; AFOSR-70-0726TR) Avail: CFSTI CSCL 7/5

The nature of chemical bonding and chemical dynamics has been elucidated by the investigation of molecules possessing exceptional energy content. Included are the authors publications. TAB

N70-31012# Electricity Council Research Center, Capenhurst (England).
A STUDY OF LITHIUM ELECTRODES AND PROPYLENE CARBONATE SOLUTIONS
D. Gilroy Sep. 1969 30 p refs
(ECRC/N208) Avail: CFSTI

Lithium electrodes and propylene carbonate solutions were studied by measurements of relative viscosity and potential-time curves over the temperature range from -40 C to 140 C. Diffusion coefficients, equivalent conductivities, solvation numbers and limiting current densities were derived from the experimental data. Ionic movements in the 0.5M solutions used were interpreted in terms of the Stokes' equation and conductivity theory. Platinum substrates were unsuitable for lithium electrodes. An active site mechanism

was proposed to account for the transient behavior. Exchange current densities were too high to measure with any precision. Solvent decomposition occurred at temperatures above 160 C. Author

N70-31015# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFRARED ABSORPTION SPECTRA OF SOME MONOETHERS OF PHENYLETHYLENE GLYCOL

I. M. Mamedov et al 17 Dec. 1969 7 p refs Transl. into ENGLISH from Azerb. Khim. Z. (Baku), no. 3, 1968 p 7 - 11 (AD-702966; FTD-HT-23-327-69) Avail: CFSTI CSCL 7/4

The IR spectra of 1:1 monoethers of phenylethylene glycol which possess intensive activity were studied. A change in the structure of the alcohol radical of the indicated compound does not cause noticeable changes in the IR spectra. The only significant change noted is displacement by 15/cm of the frequency of V C- O- C toward the side of higher values in the case when R is CH3. No connection was found between the insecticidal activity of the investigated monoethers of phenylethylene glycol with their IR spectra. Author (TAB)

N70-31016# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF THE PROPERTIES OF ANODIC FILMS ON SILVER

G. A. Golikov et al 11 Dec. 1969 5 p refs Transl. into ENGLISH from Tr. Khim.-Tekhnol. Inst. (Kazan), no. 36, 1967 p 255 - 257 (AD-702965; FTD-HT-23-505-69) Avail: CFSTI CSCL 7/4

Anodic oxidn. of Ag was studied in 0.1 n Na OH. The samples were mech. polished plates 7.2 sq. cm and wires 0.6 sq. cm. The anodic c.d. was 50 Mu amp/sq cm. The differential capacitance was measured by the pulse method. The capacitance varies considerably during electrolysis. The variation is greatest at the transition from the lower oxide to the higher one, which is accompanied also by a considerable change in electrode potential. With increasing thickness of the oxide, a relatively small but const. decrease in capacitance is observed. The detection of the type of condition of 'dry' surfaces of anodic Ag oxides pointed to the electronic nature of condition of the surface layer, which is in agreement with the measurement of photogalvanic activity of the electrode during electrolysis. Author (TAB)

N70-31034# Boeing Scientific Research Labs., Seattle, Wash. Polymer Sciences Lab.

POLYTRIAZOLINE

Paul M. Hergenrother and Luther A. Carlson Dec. 1969 20 p refs (AD-701157; D1-82-0940) Avail: CFSTI CSCL 7/3

Relatively high molecular weight (n(inh) about 0.6 dl/g) soluble polytriazolines have been prepared by the solution polymerization of 2,6-pyridinediyl dihydrazidine with three different aromatic dialdehydes. Thermogravimetric analysis of the polytriazolines showed weight losses in air and in nitrogen commencing at 280C and 400C, respectively. Several attempts to convert triazoline model compounds to the corresponding 1,2,4-triazoles and to quantitatively prepare methyl substituted triazoline model compounds were unsuccessful. Author (TAB)

N70-31049# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME PROPERTY CHANGE IN PYROLITIC SiO2 FILMS AFTER THERMAL TREATMENT

R. P. Kalnynya et al 8 Jan. 1970 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. i Tekh. Nauk (Riga), no. 3, 1968 p 13 - 18 (AD-702964; FTD-HT-23-5-70) Avail: CFSTI CSCL 7/4

Changes in the etch rate, refractive index, and infrared absorption spectra for pyrolitic SiO2 films, along with variations in the volt-ampere characteristics for Ag-SiO2-Ge structures, after thermal treatment in various gas media have been studied. It has been established that thermal treatment of pyrolitic SiO2 films has the effect of stabilizing all the properties considered. The treatment of films in water vapor at temperatures above 70 degrees centigrade has proven to be the most effective. It has been found that the properties which depend on the etch rate of the films become stable in a shorter time than the volt-ampere characteristics. Thermal treatment exercises a substantial effect particularly on films grown in an oxygen medium at low temperatures. Author (TAB)

N70-31075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF THE THERMODYNAMIC PROPERTIES OF DISSOCIATING NITROGEN TETROXIDE TAKING NONIDEALITY INTO ACCOUNT

V. B. Nesterenko et al 25 Nov. 1969 11 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekh. Navuk (Minsk) no. 3, 1966 p 20 - 24 (AD-702969; FTD-HT-23-303-69) Avail: CFSTI CSCL 7/4

This study was undertaken because of the lack of experimental data on the enthalpy of dissociating nitrogen tetroxide. At calculation of the entropy (S) and enthalpy (I) of dissociating N2O4 was performed in the temperature range 300-1500K and 1-140 atm range, taking into account deviation of the reaching N2O4 from ideal behavior. The calculation was carried out on the basis of general thermodynamic functions of the thermodynamic theory of empirical corrections and of generalized tables. The calculated S and I values were used for plotting I-S and T-S diagrams. Author (TAB)

N70-31078# Bochum Univ. (West Germany).

SOOT FORMING: NEW RESULTS [RUSSBILDUNG: NEUERE ERGEBNISSE]

H. G. Wagner *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 25 - 40 In GERMAN (See N70-31076 16-28) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

Two soot-forming methods for premixed flames are discussed: (a) acetylene flames where the soot is formed over the entire flame cone; (b) flames where the carbon is only formed at the cone tip either directly over the flame front or at a short distance from it. Experiments with acetylene and benzene flames are discussed. ESRO

N70-31095 National Lending Library for Science and Technology, Boston Spa (England).

INVESTIGATION OF POLARIZATION DURING THE ELECTRODEPOSITION OF Ni-W ALLOYS AT TEMPERATURES ABOVE 100 C

A. T. Vasko et al 20 Apr. 1970 9 p refs Transl. into ENGLISH from Elektrokhim. (USSR), v. 5, no. 8, Aug. 1969 p 961 - 964 In ENGLISH and RUSSIAN (NLL-Trans-746-407-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The polarization during discharge of Ni-W alloys and of hydrogen and nickel from ammonia-borate and ammonia-tartrate electrolytes was investigated in a temperature area, where nickel is discharged from simple electrolytes without overvoltage. The composition of the electrolytes are given in tabular form and the constant pH of the solutions was maintained with the help of sulfuric acid and ammonium hydroxide. The studies show that electrodeposition of tungsten causes an increase in the overvoltage of the metal deposit due to a decrease in the concentration of metal ions, formation of complex compounds of the metal deposit, and formation of almost insoluble compounds of the metal deposit in the electrode layer. R.B.

N70-31174 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF CENTRIFUGAL FORCE ON CHEMICAL SYSTEMS [UEBER DEN EINFLUSS DER ZENTRIFUGALKRAFT AUF CHEMISCHE SYSTEME]
G. Bredig 1970 24 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 17, 1895 p 459-472 In ENGLISH and GERMAN
(NLL-CA-Trans-238-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The question of whether the effect of external forces such as gravitation can produce changes in concentration in a homogeneous mixture in the direction of the forces is discussed. According to the principle of the smallest constraint, it is stated in general that if an isolated system in a given volume in mobile chemical equilibrium at a given temperature is altered due to the effect of external forces, the spatial displacement taking place in the concentrations of its constituents corresponds to a positive work output of the forces. R.B.

N70-31178# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
CARBON DIOXIDE ABSORPTION BY SODA LIME; A LITERATURE SURVEY [KOOLDIOXIDE-ABSORPTIE DOOR NATRONKALK: LITERATUURSTUDIE]
W. F. Keller Mar. 1970 42 p refs In DUTCH; ENGLISH summary
(Rept-1970-9; TDCK-55625-II) Avail: CFSTI

When soda lime is used as a carbon dioxide absorbent, the preferred composition is: + or - 80% calcium hydroxide, + or - 5% sodium hydroxide, and + or - 15% water. The sodium hydroxide activates the absorption reaction, and the water performs two tasks. Firstly, at the manufacturing stage, it has a definite influence on the hardness and porosity of the material; secondly it is necessary for the absorption reactions. The physical and chemical properties are only slightly influenced by additives such as active charcoal, asbestos, pumice, and silicates. Two methods for the calculation of an absorber are described. One uses the linearity between the zone velocity and the ratio of linear gas velocity and bulk density augmented with the thickness of the dead layer in dependence of absorber and particle diameter. The other uses a mass balance and a relation between saturation value and the ratio of absorber cross section and breakthrough time. Efficiencies lower than 35% of the theoretical value are found because of the enclosing of the interior surface of the particle by a layer of CaCO3, formed during absorption. Author

N70-31220# Missouri Univ., Rolla. Dept. of Physics.
CROSS SECTION FOR PHOTOIONIZATION OF EXCITED CESIUM ATOMS Annual Report, 1 Mar. 1969 - 28 Feb. 1970
Kasre J. Nygaard and Robert E. Hebner, Jr. 30 Mar. 1970 43 p refs
(Contract N00014-68-C-0271)
(AD-703628; TR-1) Avail: CFSTI CSCL 7/4

The objective of the present program is to determine the cross section for photoionization of excited cesium atoms. The highlight of the experiment is to use a thermally tunable gallium-arsenide laser to generate a high concentration of atoms in the first excited state, and then to ionize the excited atoms by means of radiation from a monochromator. The cross section for this process is about 100 times larger than that for photoionization of ground-state cesium atoms, and for this reason the corresponding non-equilibrium rates are significant in thermionic energy converters and MHD generators. During the first contract period most of the apparatus that will be used in the experiment was constructed and tested. This includes an ultra-high vacuum system, atomic beam oven and detector, and optical radiation sources and detectors. Special emphasis has been put on the properties of the gallium-arsenide lasers. Author (TAB)

N70-31228# California Univ., Livermore. Lawrence Radiation Lab.
BEHAVIOR OF RADIONUCLIDES IN NUCLEAR GAS STIMULATION TECHNIQUES
C. F. Smith, Jr. 21 Dec. 1969 15 p refs Presented at ANL Topical Meeting, Eng. with Nucl. Explosions, Las Vegas, Nev., 14-16 Jan. 1970 Sponsored by AEC
(Proj. Gasbuggy)
(UCRL-72182; PNE-G-56; CONF-700101-5) Avail: CFSTI

Both aspects of the gas quality program for Gasbuggy are discussed. The study of Gasbuggy results is divided into two distinct periods, according to the field operations. During the initial six months following detonation, the chimney reentry well was shut-in, and the nuclear chimney served as a chemical and radio-chemical reaction vessel. A detailed examination of the concentrations and specific activities of tritium and C-14 is presented as a function of the changing chemical composition of the chimney gas and as a function of time. The effects of radiochemical exchange reactions, together with the tritium isotope effect, are demonstrated. Following this shut-in period, a series of production and flushing tests was conducted. During these experiments, the chimney gas composition was seen to change about as would be expected due to dilution of the chimney gas with formation gas. The discussion involves estimation of initial distribution of activities, the effects of chemical reactions and isotopic exchange on this distribution, and the importance of the environment in determining the level of radioactivity contamination to be expected. Author (NSA)

N70-31227# National Lead Co. of Ohio, Cincinnati.
THE DEVELOPMENT OF A URANIUM ISOTOPIC ANALYTICAL PROGRAM AT THE USAEC FEED MATERIALS PRODUCTION CENTER
Richard D. Ohlinger 14 Aug. 1969 48 p refs Presented at 1969 Intern. Conf. on Mass Spectroscopy, Kyoto, 8 Sep. 1969
(Contract AT(30-1)-1156)
(NLCO-1045; CONF-690926-3) Avail: CFSTI

The isotopic assays are made by gamma spectrometry and by mass spectrometry utilizing eight UF6 isotope ratio spectrometers and one surface ionization spectrometer. The gamma spectrometric method is used to assay uranium materials with unknown or suspect U-235 concentrations. The development of this rapid method and its application as a supplemental method to the mass spectrometric analyses are described briefly. The method employing isotope ratio UF6 gas mass spectrometers is used to assay the uranium product materials with known U-235 levels. Two methods and the facilities for converting U3O8 samples to UF6 are described. Modifications made to the UF6 spectrometers are also presented. The concentrations of the minor uranium isotopes are determined with the surface ionization mass spectrometer. Internal and external analytical quality control programs are reviewed. Author (NSA)

N70-31232# Los Alamos Scientific Lab., N. Mex.
COMPUTER CALCULATIONS IN SPECTROCHEMICAL ANALYSIS
John R. Phillips, James F. Murphy, and Calvin J. Martell 1969 19 p refs Presented at Pacific Conf. on Chem. and Spectry., Anaheim, Calif., 10 Oct. 1969
(Contract W-7405-eng-36)
(LA-DC-10556; CONF-691037-1) Avail: CFSTI

A computer in Fortran IV is described; it calculates the concentration of impurities in plutonium and uranium from either optical density or percent transmittance data obtained from a spectrogram of the samples. A second Fortran IV program is used for a complete emulsion calibration. NSA

N70-31233# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CONSISTENCY EVALUATION OF ACCOUNTABILITY DATA

FOR A CHEMICAL PROCESSING PLANT
D. E. Christensen and R. A. Schneider 18 Nov. 1969 37 p refs
(Contract AT(45-1)-1830)
(BNWL-CC-2346-Rev) Avail: CFSTI

Accountability data collected during the normal dissolution of irradiated fuel at a chemical reprocessing plant were evaluated. Results important to safeguarding nuclear materials are presented. Author (NSA)

N70-31236# Union Carbide Corp., Oak Ridge, Tenn. Gaseous Diffusion Plant.
ENGINEERING DEVELOPMENT OF AN ABSORPTION PROCESS FOR THE CONCENTRATION AND COLLECTION OF KRYPTON AND XENON Summary Progress Report, Jan.–Jun. 1969
J. R. Merriman and J. H. Pashley 1 Apr. 1970 16 p refs
(Contract W-7405-eng-26)
(K-1787; Rept-5) Avail: CFSTI

A selective process for removing krypton and xenon from contaminated gas streams by preferential dissolution in a fluorocarbon solvent is being developed at the Oak Ridge Gaseous Diffusion Plant. The technique being studied is a continuous absorption-stripping process. Pilot plant demonstration of this process forms the major part of the ORGDP program, although conceptual plant design work and process optimization studies supplement the experimental effort. The first phase of the testing program, in which refrigerant-12 was used as the process solvent, was successfully completed. Pending further definition of process application guidelines, the conceptual plant design part of the project was temporarily suspended. The optimization studies were continued, however, with the investigation of an absorption plant suitable for removing the krypton and xenon that might be present in the argon cover gas of a vented fuel breeder reactor. Author (NSA)

N70-31238# California Univ., Berkeley. Lawrence Radiation Lab.
SOME MAGNETIC, SPECTROSCOPIC AND CRYSTALLOGRAPHIC PROPERTIES OF BERKELIUM, CALIFORNIUM, AND EINSTEINIUM
Dennis Ken Fujita (Ph.D. Thesis) Nov. 1969 175 p refs
(Contract W-7405-eng-48)
(UCRL-19507) Avail: CFSTI

Procedures for the purification, assay, and evaluation of sample purity are discussed for Bk(249), Cf(249), and Es(253). The experimental techniques used to study the magnetic susceptibilities of berkelium metal, Bk-3(+), and Cf-3(+) are described. The susceptibilities of Bk-3(+) and Cf-3(+) follow the Curie–Weiss relationship. Among 3 samples of berkelium metal both ferromagnetism and antiferromagnetism were detected at low temperature; at higher temperatures the susceptibilities follow the Curie–Weiss law. Effective magnetic moments derived from the high-temperature data suggest that greater than 3 electrons per atom occupy bonding orbitals. Techniques to prepare several Bk-249, Cf-249, and Es-253 compounds on the microgram scale are discussed. Standard X-ray diffraction powder methods are applied in the determinations of the crystal structures and lattice parameters of the Bk and Cf compounds. Author (NSA)

N70-31262# Massachusetts Inst. of Tech., Cambridge.
CHEMISTRY PROGRESS REPORT
31 Dec. 1969 61 p refs
(Contract AT(30-1)-905)
(MIT-905-194) Avail: CFSTI

Developments are reported for studies on: nuclear chemistry, including radioactive decay and nuclear structure and fission; physical chemistry; earth and environmental sciences; instrumentation; instrumental chemistry; and hot atom chemistry, including ion–molecule reactions. NSA

N70-31270# California Univ., Livermore. Lawrence Radiation Lab.
GAS QUALITY ANALYSIS AND EVALUATION PROGRAM FOR PROJECT GASBUGGY
C. F. Smith 19 Dec. 1969 19 p refs Presented at ANS Topical Meeting, Eng. with Nucl. Explosives, Las Vegas, Nev., 14–16 Jan. 1970 Sponsored by AEC
(Proj. Gasbuggy)
(UCRL-72153; PNE-G-55-Conf-700101-14) Avail: CFSTI

Experimental results of the gas quality analysis program for Project Gasbuggy through August 1969 are presented graphically, addressing the questions raised by the preshot program goals. The chemical composition and the concentrations of tritium, krypton-85, carbon-14, and argon-37, 39 are presented as a function of time and gas production from the nuclear chimney. Chemically, the presence of CO2, CO, and H2 served to dilute the formation gas and caused reactions that significantly altered the gas composition at early times. The radionuclide content of the chimney gas at reentry was some 800 pCi/cu cm of which about 80% was CH3T. Lesser quantities of tritium were observed as HT, C2H5T, and C3H7T. The other major contaminant was Kr-85 which was present at about one-fifth the level of CH3T. Small quantities of carbon-14 and argon-39 were also identified. The only other radionuclides identified in the gas were relatively short-lived rare gases. Author (NSA)

N70-31279# Joint Publications Research Service, Washington, D.C.
WATER VAPOR PRESSURE AS A FUNCTION OF THE CONCENTRATION OF THE ANOMALOUS COMPONENT IN MODIFIED WATER
B. V. Deryagin et al 1 Jul. 1970 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 190, no. 2, 1970 p 372–375
(JPRS-50858) Avail: CFSTI

Observations on the distillation of columns of modified water into the free portion of a sealed capillary show that the anomalous component is almost nonvolatile at room temperature. Heat expansion curves were used for the characteristics of the properties of the condensate and the modified water column. To exclude the possibility of thermocapillary transfer in a film of liquid on the surface of the capillary, part of the capillary with the modified water column was separated by an extension from the free portion in which the condensation was put. The Raoult law is used to determine the molecular weight by an independent method. If columns of maximally modified water and ordinary water are placed in contact in a capillary, a clear interphase boundary is observed between them, which blurs and disappears after several days. Author

N70-31289 National Lending Library for Science and Technology, Boston Spa (England).
GAS CHROMATOGRAPHY OF INORGANIC FLUORINE COMPOUNDS [GAS-CHROMATOGRAPHIE ANORGANISCHER FLUORVERBINDUNGEN]
O. Pitak 23 Mar. 1970 14 p refs Transl. into ENGLISH from Chromatographia (West Germany), v. 2, no. 10, 1969 p 462–465 In ENGLISH and GERMAN
(NLL-CA-Trans-234-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The efficiency of a separation capillary as a function of the viscosity of the stationary phase, as well as with the amount of the specific interaction energy when using thermodynamic indications for fluorine and uranium hexafluoride is investigated. Author

N70-31301# Naval Ordnance Lab., White Oak, Md.
HIGH-TEMPERATURE MEASUREMENTS OF THE RATE OF UPTAKE OF RUBIDIUM CHLORIDE VAPOR BY SELECTED OXIDES

Charles E. Adams, M. H. Rowell, and J. T. Quan 27 Jan. 1970 36 p refs
(Contract AT(49-7)-1963)
(AD-703608; NOLTR-69-191) Avail: CFSTI CSCL 18/8

In a program for the elucidation of the process of formation of radioactive fallout, the rates at which substrate samples of a clay loam and a calcium ferrite took up vaporized rubidium chloride were measured. The rate measurements were made in air from 1100 to 1450C and over a rubidium chloride partial pressure range of about 1 x 10 to the 6th to 5 x 10 to the -4th atm. The clay loam took up rubidium chloride vapor at a rate determined by the rate of diffusion of the rubidium chloride vapor through the surrounding air. The calcium ferrite took up the rubidium chloride at a slower rate which was governed by the rate of reaction of the rubidium chloride with the calcium ferrite at the substrate surface. The uptake of rubidium chloride vapor by a series of simple, unmelted oxides at 1400C was also measured. In general, the rubidium chloride reacted most with acidic oxides such as Nb2O5 and TiO2 and least with basic oxides such as SrO and MgO. Author (TAB)

N70-31304# IIT Research Inst., Chciago, Ill. Dept. of Chemistry.
MASS SPECTROMETRIC OBSERVATIONS OF GASEOUS BORON SELENIDES
Robert C. Melucci and P. G. Wahlbeck [1970] 12 p refs
(Contract AT(11-1)-1029)
(COO-1029-33) Avail: CFSTI

The vapor species evaporating from a sample prepared to be B2Se3 were identified with a time-of-flight mass spectrometer. The sample was heated to progressively higher temperatures over the range from 100 C to 700 C. The sample was contained in a tungsten Knudsen cell. Parent gaseous species believed to be present were BSe2(g) and B2Se3(g). In addition there were products from the hydrolysis reaction with the condensed B2Se3 phase. These results are compared with those for B–S system by Gilles et al. The B–S and B–Se systems show similar vaporization behavior; the principal difference observed was the absence of gaseous polymers of BSe2 and B2Se3. Author (NSA)

N70-31324# Rochester Univ., N.Y. Inst. of Optics.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE OPTICAL PROPERTIES OF ORGANIC CRYSTALS Final Report, 14 Feb. 1966 – 30 Apr. 1969
Kenneth J. Teegarden 15 Jan. 1970 3 p
(Grant DA-ARO(D)-31-124-G931)
(AD-703019; AROD-6521-3-P) Avail: CFSTI CSCL 7/4

Results are reported on the intrinsic luminescence of crystals of krypton and argon, and on the luminescence of simple molecules as impurities in these crystals. Author (TAB)

N70-31346# Naval Weapons Station, Yorktown, Va. Explosives, Physics and Chemistry Div.
A COMPARISON OF EXTRACTION SOLVENTS FOR THE ANALYSIS OF COMPOSITION A-3 EXPLOSIVE
Edwin R. Cousins and Winona C. Hogge 25 Mar. 1970 18 p refs
(AD-703217; NWSY-TR-70-1) Avail: CFSTI CSCL 19/1

Three solvents - benzene, aliphatic naphtha, and carbon tetrachloride - were evaluated as extraction solvents for the separation of wax and RDX in Composition A-3 explosive. Control samples of wax and RDX prepared in the laboratory and samples from nine blends of Composition A-3 were analyzed using standardized procedures for each solvent. Benzene was not satisfactory; the other solvents were acceptable. Laboratory technicians, production materials, and simple laboratory facilities were used throughout the work. Detailed extraction procedures are included. Author (TAB)

N70-31384# Technische Hochschule Munchen (West Germany).
RING CLOSING REACTIONS OF N-ARYLAMIDINES AND THEIR ANALOGS [RINGSCHLUSSREAKTIONEN VON N-ARYLAMIDINEN UND DEREN ANALOGA]
Karl Dietmar Augart (Ph.D. Thesis) 1969 68 p refs In GERMAN
Avail: CFSTI

Reactions of N-arylamidines, N-arylguanidines, and N-arylisothiourea with p-toluolsulfonylisonitrildichloride produced chinazolone-(4)-p-toluolsulfonylamine. An analog reaction with phosphordiimide to obtain closed ring phosphediazines gave negative results. Reactions of N-arylamidines with chloral also did not produce the desired cyclization to the chinazoline ring; but ring closure can be obtained by using acetanhydride. N-phenyl-N',N'-dimethylguanidine and N-phenyl-S-methyl-isothiourea formed with two mole chloral into oxadiazine derivatives. The guanidine derivative formed with chloral also the intermediate aminal and the aminal. It is shown that the intermediate aminal is present during oxadiazine as well as during aminal formation. Transl. by G.G.

N70-31396*# Gillette Research Inst., Inc., Rockville, Md.
EVAPORATION RATE OF MERCURY AS AFFECTED BY SMALL PROPORTIONS OF CONTAMINANTS Final Report
Anthony M. Schwartz and Silvestre B. Tejada 20 Apr. 1970 21 p refs
(Contract NAS3-11522)
(NASA-CR-72715) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 07D

The evaporation rate of pure mercury was compared to that of mercury dosed to the extent of .02% (200 ppm) with eleven different metallic contaminants. The evaporations were performed at 0.000005 Torr and 24 C. Four of the contaminants, magnesium, sodium, lithium and tin, lowered the evaporation rate to less than 1% that of the pure mercury. The molecular mechanism of the lowering was not established. Author

N70-31403 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF RE-WORKING OF ARSENIC-CONTAINING PRODUCTS AT SEVERONICKEL COMBINE
R. K. Alekseeva et al 20 Apr. 1970 10 p Transl. into ENGLISH FROM Tsvetn. Metal. (Moscow), v. 43, no. 1, Jan. 1970 p 17-19 In ENGLISH and RUSSIAN
(NLL-Trans-746-496-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The reworking of dust waste of metallurgical production, especially with the introduction of electro-filters, was investigated. The dust comprised a very fine material, 90% being particles of less than 10 microns, enriched by nickel, copper, cobalt, and harmful admixtures such as zinc, lead, and arsenic. X-ray diffraction and microscopic investigations of dust and solid residues after aqueous and acid washing show that the dusts have a complicated mineralogical composition and represents a mechanical mixture of particles of the nickel alloy, oxides, sulfides, sulfates, and silicate compounds. By comparing the two described processes a proposition concerning the combined reworking of iron cake and dusts is developed. During reworking the action of the surplus Fe sulfate salts in the filtrate can be calculated from the solubility of iron cake on arsenic contained in the solutions from leaching out of dusts and dissolution of the cake. Author

N70-31404 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF WATER TEMPERATURE ON THE CAPACITY OF ION EXCHANGE EQUIPMENT
H. W. Kauczor 1970 12 p refs Transl. into ENGLISH from

VGB Feed-Water Conf., 1968 p 66 - 70
(NLL-RISLEY-Trans-1831-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl. 1 NLL photocopy coupons

Ion exchangers are discussed in terms of diffusion processes dependent on the mobility of ions, and greatly affected by temperature. Topics studied include the following: water temperature and nominal capacity of ion exchangers; weak and strong acid exchangers, weak and strong base exchangers; and water temperature and working life of exchangers. F.O.S.

N70-31409# Pittsburgh Univ., Pa. Dept. of Chemistry.
BIOLOGICAL APPLICATIONS OF MOESSBAUER SPECTROSCOPY Progress Report, Feb. 1969 - Feb. 1970
L. M. Epstein and Darel K. Straub Feb. 1970 55 p refs
(Contract AT(30-1)-3859)
(NYO-3859-8) Avail: CFSTI

Research is reported on magnetic susceptibility measurements and Mossbauer spectra. The magnetic susceptibility measurements were made over the 2.8 to 280 K temperature range for iron(III)bis dithiocarbamates, and their Mossbauer spectra were obtained. Iron(III)bis dithiocarbamates were prepared and their spectra were also obtained. Possible methods of preparing iron complexes containing coordinated molecular nitrogen are described. Research summaries are included on magnetic susceptibility measurements and Mossbauer spectra on other iron(III) complexes and bonds in iron porphyrin systems. N.E.N.

N70-31455# Kentucky Univ., Lexington. Dept. of Chemistry.
THE VIBRATIONAL SPECTRUM OF 2,2-DIAMINOHEXAFLUOROPROPANE
Kenneth E. Blick, Clifford D. Miller, and Kurt Niedenzu Jan. 1970 19 p refs
(Contract DAAB07-69-C-0366; Proj. Themis)
(AD-703894; THEMIS-UK-RR-6) Avail: CFSTI CSCL 7/4

The vibrational spectrum of 2,2-diamino-hexafluoropropane has been studied and interpretation of the data was facilitated by recording the spectrum of the N-perdeuterated species. On that basis, complete assignment of the fundamentals is being suggested. Author (TAB)

N70-31457# Oak Ridge National Lab., Tenn.
FORMATION OF THO2 MICROSPHERES BY A FREEZE-FORM VACUUM-DRY TECHNIQUE
R. A. Bowman Apr. 1970 9 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2872) Avail: CFSTI

The feasibility of producing microspheres from sols by a freeze-form vacuum-dry process was demonstrated. Thoria microspheres were formed by injection of sols of various concentrations into a cooling bath of trichloroethylene at -20C, dehydration for 1 to 6 hr at 1 × 0.000001 torr, and calcination for 4 to 6 hr at 1000 to 1800 C. Microspheres with densities of 17 to 64% of theoretical were successfully produced. Author (NSA)

N70-31461# Michigan State Univ., East Lansing.
INVESTIGATIONS OF STEREOSPECIFIC ELECTRODE PROCESSES Final Report, 22 Jan. 1965 - 31 Aug. 1969
Richard S. Nicholson Feb. 1970 34 p refs
(Contract DA-31-124-ARO(D)-308)
(AD-702986; AROD-5288-9-C) Avail: CFSTI CSCL 7/4

A summary is given of theoretical work which involved development of several new techniques, especially potential step-linear scan electrolysis, for studying homogeneous and heterogeneous kinetics associated with electrode processes. Experimental research in three general areas also is summarized: (1) evaluation of the new theory that was developed; (2) elucidation of the mechanism of selected electrode processes; and (3) attempts to correlate the influence of molecular structure on heterogeneous electron transfer kinetics. Author (TAB)

N70-31463# Massachusetts Inst. of Tech., Cambridge.
THE REACTION OF ORGANIC ANIONS WITH CARBON MONOXIDE
George M. Whitesides 1969 95 p refs
(Grant DA-ARO(D)-31-124-G691)
(AD-702990; AROD-5444-7-C) Avail: CFSTI CSCL 7/3

The research described has been directed toward two objectives: first, elucidation of the mechanism of reaction of carbon monoxide with organolithium reagents; and second, exploration of the reactions of dialkyl-substituted acetylenes with triarylchromium(III) compounds. The broad outline of the former mechanism has been established. The initial step in the reaction involves formal insertion of carbon monoxide into an organolithium aggregate (illustrated by phenyllithium dimer) followed by partitioning of the resulting ketone dianion between two principal competing reaction paths leading ultimately after hydrolysis to benzhydryl phenyl ketone, benzhydrol, and benzophenone as the principal reaction products. The work is of interest as a potential entry into the chemistry of ketyls and ketone dianions, and for its elaboration of a unique mechanistic pathway for a reaction of an organolithium reagent. The cyclooligimerization of 2-butyne to 1,2,3,4-tetramethylnaphthalene on reaction with triphenyltris(tetrahydrofuran)chromium(III) has been shown to involve initial insertion of acetylene into a carbon-chromium sigma-bond, followed by elimination of benzene with formation of an intermediate metallocycle. The work also establishes a basis for rational application of organochromium reagents in certain types of organic synthesis, in addition to providing the most clearly established description available for cyclooligimerization of an acetylene using a transition metal catalyst. Author (TAB)

N70-31465# Mellon Inst., Pittsburgh, Pa.
ANALYSIS OF N-BUTYL CHLOROPHENOXYACETATES BY GAS CHROMATOGRAPHY AND INFRARED SPECTROSCOPY Technical Report, Sep. 1968 - Jul. 1969
James J. Headings, Ronald G. Lewis, William J. Crawford, and Wilbert R. Powell Jan. 1970 41 p refs
(Contract F33615-68-C-1369)
(AD-702843; AFML-TR-69-281) Avail: CFSTI CSCL 7/4

A gas chromatographic method was developed for the analysis of samples of n-butyl 2,4-dichlorophenoxyacetate, n-butyl 2,4,5-tri-chlorophenoxyacetate, and mixtures of these two compounds. These mixtures are called herbicide orange. Samples of n-butyl 2, 4-dichlorophenoxyacetate (four), n-butyl 2,4,5-trichlorophenoxyacetate (four), and herbicide orange (15) were analyzed by gas chromatography. No less than 23 impurity peaks were obtained in the collective chromatograms. Six peaks were the most common impurities. They appeared in a number of chromatograms and often accounted for a major portion of the impurity content. The number and amount of impurities varied considerably in the different samples, even in samples from the same source. The n-butyl 2,4-dichlorophenoxyacetate and the n-butyl 2,4,5-trichlorophenoxyacetate content of the herbicide orange samples was determined by both infrared and gas chromatographic methods. The results from the two methods are compared, and some of the factors which influenced these results and their reliability are discussed. Author (TAB)

N70-31474# Army Chemical Center, Edgewood, Md. Ground Munitions Lab.
TESTING AND EVALUATION OF PYROTECHNIC MIXTURES CONTAINING CHEMICALS
Mitchell E. Penn Apr. 1970 11 p
(AD-704317; EASP-200-3) Avail: CFSTI CSCL 19/1

The methodology of testing pyrotechnic mixtures containing chemicals is explained. The use and the design of chambers, wind tunnels, and sampling equipment are described and analyzed. Author (TAB)

N70-31485# Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
DENSITY OF CRYOGENIC LIQUID MIXTURES Final Report, 1 Oct. 1965 - 31 Dec. 1969
Frank B. Canfield Dec. 1969 6 p refs
(Grant AF-AFOSR-1020-66)
(AD-702823; AFOSR-70-0789TR) Avail: CFSTI CSCL 20/13

A brief summary is given on work involving both an experimental and theoretical investigation of the thermodynamic properties of cryogenic liquid mixtures. TAB

N70-31494# Princeton Univ., N.J. Frick Chemical Lab.
MODELS OF A DEGRADING POLYMER NETWORK
Montgomery T. Shaw Mar. 1969 29 p refs
(Contract N00014-67-A-0151-0011)
(AD-703909; RLT-122) Avail: CFSTI CSCL 7/4

Regular, two and three dimensional networks of linear analogs to elastic polymeric chains were degraded randomly in an attempt to establish a relationship between the force produced by a constantly strained network and the number of chain scissions. This behavior is important for the quantitative interpretation of chemical stress relaxation data. The models showed that the initial modulus of the three dimensional networks should vary as the number of crosslinkages (tetrafunctional) to the 4/3 power. The initial rate of decay of the relative force for random main chain cleavage was (in the limit of infinite network size) equal to twice the rate of decay of the relative number of chains between the crosslinkages. At high degrees of degradation (relative number of chains between crosslinkages equal to 1/e), the models indicated that the relative force would approach zero in the limit of infinite network size. The behavior of the models showed that the force decay of a degrading network is considerably more rapid than had been generally thought. Author (TAB)

N70-31498# Technische Hochschule Munchen (West Germany).
ON REACTIONS OF PLATINUM(0) AND HYDRIDO-PLATINUM COMPLEXES WITH ORGANIC AZIDES AND ON COMPLEX METAL AZIDES [UEBER REAKTIONEN VON PLATIN(0) - UND HYDRIDO-PLATIN-KOMPLEXEN MIT ORGANISCHEN AZIDEN UND UEBER KOMPLEXE METALL-AZIDE]
Manfred Bauder (Ph.D. Thesis) 1969 89 p refs In GERMAN
Avail: CFSTI

End compounds obtained from reactions of phosphine-containing platinum(0) complexes and hydrido-platinum compounds with organic azides depended very much on reaction conditions and the type of azides used. (Ph 3P) 4 Pt reacted with sulfonyl-azides in benzole solutions and in the presence of water by forming amido complexes; phosphineimine RSO(2)N = PPh(3) and sulfonamide RSO(2)NH(2) were also isolated in these reactions. A comparative reaction with chloramine T in aqueous benzole solution resulted in the analoge compounds (Ph3P)2Pt(X) (NHSO2 C6H4CH3) (X = OH, Cl, NHSO2C6H4Ch3). The ethylene complex (Ph3P)2PtC2H4 reacted with sulfonylazides compounds in benzole to form compounds of the types (Ph3P)2Pt(N2SO2R)2 (R = C6H5, CH3C6H4). Acyl- and aroylazides formed in ethanol solutions only azido-platinum complexes of the form (Ph3P)2Pt(N3)2. Reactions of hydrido-platinum complexes of the type trans-(R3P)2PtHX (R = C2H5, C6H5; X = Cl, Cn, NCO, N3) with a number of organic azides produced stable monomeric amido-complexes (R3P)2Pt(S)NHR'. The observed reaction steps indicated electrophilic attack of the organic azide on the coordinated unsaturated platinum. Infrared spectroscopy established that amido-hydrogen was readily exchangeable with deuterium. Transl. by G.G.

N70-31514# Fulmer Research Inst., Ltd., Stoke Poges (England).
HEATS OF FORMATION OF LIGHT ELEMENT COMPOUNDS Final Scientific Report, 1 Sep. 1960 - 31 Dec. 1969
P. Gross and C. Hayman Mar. 1970 13 p refs
(Contracts AF 61(052)-447; AF 61(052)-863)
(AD-704139; R 163/38; AFOSR-70-0999TR) Avail: CFSTI CSCL 7/4

The standard enthalpies of formation (values in kcal in parentheses) of BeF2(c) (-245.3) and of Al2O3.3H2O (gibbsite) (-618.7) and the standard enthalpies of combination (values in kcal in brackets) in the double compounds, 2BeO.Li2O(c) (-3.9), B2O3.3BeO(c) (-9.3), Al2O3.Li2O(c) (-25.0), Al2O3.B2O3(c) (-16.1), 9Al2O3.2B2O3(c) (-24.5), LiBeF3(c) (-1.2) and alpha-Li2BeF4 (-2.7) have been determined calorimetrically. The heat of combination in 5Al2O3.Li2O has also been determined calorimetrically at 957K (31.4). The transport of Be(c) in BeCl2(g) has been investigated and when formulated as the equilibrium of the reaction Be(c) + BeCl2(g) = 2BeCl(g) one deduces log Kp = 20.480/T + 9.19. Author (TAB)

N70-31516# Kentucky Univ., Lexington. Dept. of Chemistry.
THE VIBRATIONAL SPECTRUM OF (CF3)2CNH
Kenneth E. Blick and Kurt Niedenzu Jan. 1970 19 p refs
(Contract DAA807-69-C-0366; Proj. Themis)
(AD-703895; THEMIS-UK-RR-7) Avail: CFSTI CSCL 7/4

The vibrational spectra of (CF3)2CNH and (CF3)2CND were recorded on the liquid and gaseous phase. Experimental data can be discussed on the basis of C(2v) symmetry which permits unequivocal assignment of all fundamentals. Author (TAB)

N70-31535# Cambridge Univ. (England). Cavendish Lab.
GROWTH OF BURNING TO DETONATION IN LIQUIDS AND SOLIDS Annual Summary Report, Nov. 1968 - Dec. 1969
D. Tabor, J. E. Field, P. G. Fox, and M. M. Chaudhri Dec. 1969 40 p refs
(Grant AF-EOAR-69-0044)
(AD-703744; AFOSR-70-0846TR) Avail: CFSTI CSCL 21/2

The initiation and propagation of explosion in liquids and solids has been studied with special reference to the role played by discontinuities in promoting sensitivity and the deflagration detonation transition. The growth of fast reaction in single crystals of lead and silver azide has been investigated using high speed photography. It was found that sufficiently thin crystals of these explosives burn and the dependence of deflagration velocity on crystal dimension was determined. Fracture and break-up of the crystals can occur ahead of the reaction front; in some situations these processes can stop the growth of reaction in lead azide. The effect of collapsing a bubble by a weak shock (about 1 kbar) in the neighbourhood of the azides has been studied. Adiabatic heating of the gases in the bubble was identified as the major factor in causing initiation. Experiments on lead azide have shown that its explosion temperature depends on crystal size. The amounts and kinetics of the decomposition have been recorded for various crystal types, and temperatures associated with the fracture process evaluated. In liquid explosives the role of cavities on the transition to, and propagation of, a low velocity detonation has been studied for various liquids in both thin film and three-dimensional confinement. Author (TAB)

N70-31551# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.
THE DISSOLUTION KINETICS OF LITHIATED NICKEL OXIDE IN AQUEOUS SOLUTIONS
Chin-Ho Lee and Ernest Yeager 1 Oct. 1969 149 p refs
(Contract Nonr-1439(09))
(AD-703849; TR-5) Avail: CFSTI CSCL 7/4

The dissolution kinetics of lithiated nickel oxide electrodes have been studied in aqueous acid solutions at 95C and lower temperatures at potentials from 0.20 V to 1.8 V vs SHE. The potential dependence of the dissolution rate observed at potentials anodic to about 1.3 V vs SHE fits well Vermilyeas equation indicating that the transfer of either cations or anions (depending

on the potential) across a potential energy barrier is rate controlling with most of the change in applied potential appearing between the Helmholtz plane in the oxide and that in the solution. At potentials cathodic to about 1.3V, the data also fit the same equation but with a much higher Tafel slope because much of the overall potential drop is across the space charge layer in the oxide. The activation enthalpy at the flat band potential is about 23 kcal/mole. The effects of H(+) concentration and complexing agents such as EDTA have been examined. The reaction order is 1/3 to 1/2 with respect to H(+) and 1 with respect to EDTA. No dependence of the dissolution rate on the simultaneous oxidation of Ti(+) to Ti(3+) was found. Isotopic (18O) studies have indicated that at potentials anodic to about 1.8 V vs SHE lattice oxide ions are a significant source of O2 liberated anodically probably because of p-carriers falling into surface traps involving oxide ions. Author (TAB)

N70-31552# Denver Univ., Colo.
STATISTICAL BAND MODEL PARAMETERS AND INTEGRATED INTENSITIES FOR THE 5.9 MICRON, 7.5 MICRON, AND 11.3 MICRON BANDS OF HNO3 VAPOR
Aharon Goldman, Thomas G. Kyle, and Francis S. Bonomo Jan. 1970 48 p refs
(Contract F19628-68-C-0233; ARPA Order 363)
(AD-703739; AFCRL-70-0091; SR-7) Avail: CFSTI CSCL 7/4

Quantitative absorption measurements of the 5.9 micron, 7.5 micron and the 11.3 micron bands of pure HNO3 vapor were carried out at 40C. Use was made of absorption cells of various lengths in order to obtain curves of growth. The statistical spectral band model was applied and band model parameters and integrated intensities were derived. Author (TAB)

N70-31564# Nuclear Materials and Equipment Corp., Lewiston, N.Y. Niagra Div.
THE RECOVERY OF BORON-10 FROM LOW CONCENTRATION WASTES
E. R. Schuster, L. P. Pepkowitz, R. T. Marano, J. F. McGahan, and Paul Bodnick 12 Dec. 1969 18 p refs
(Contract AT(40-1)-3292)
(NUMEC-3292-11) Avail: CFSTI

A general-purpose quantitative chemical process for reclamation of boron-10 from a variety of process wastes and side streams is described. The process consists of selective pretreatment of various scrap types, a single boron-10 separation procedure using an ion exchanger, and a crystallization process yielding high-purity boric acid crystals. Extensive demonstration of the process on a pilot scale as applied to the recovery of boron-10 from KCl-KF spent electrolyte was included. Preliminary scale-up information shows a realistic expectation of at least 98% recovery. Author (NSA)

N70-31595# Colorado Univ., Boulder.
ION-EXCHANGE SEPARATION OF SILVER AND LEAD
Harovel Grays and Harold F. Walton [1970] 6 p refs
(Contract AT(11-1)-499)
(COO-499-22) Avail: CFSTI

Silver and lead were separated on a column of carboxylic cation-exchange resin using a diethanolamine-diethanolammonium nitrate solution to elute silver. Lead was eluted with hydrochloric acid. Author

N70-31652 Virginia Polytechnic Inst., Blacksburg.
A STUDY OF THE SURFACE CATALYZED POLYMERIZATION OF ETHYLENE ON A CHROMIC OXIDE-SILICA-ALUMINA CATALYST
Herbert Leroy Whitaker, Jr. (Ph.D. Thesis) 1969 241 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 69-19989

An exploratory study of the phenomena associated with the polymerization of ethylene on a chromic oxide-silica-alumina catalyst is discussed. By determining the monomer reaction rate versus time, the catalyst activity was found to change greatly during the polymerization. The activity increased to a maximum, then decreased. The period of increasing catalyst activity corresponded to the period of catalyst particle size reduction. The molecular weight distributions for a series of samples from each polymerization test were determined on a gel permeation chromatograph. These distributions for each test were characterized by an increase in the high molecular weight tail as the yield increased, while the peak position and low molecular weight end remained essentially constant. Dissert. Abstr.

N70-31661*# Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.
DEVELOPMENT OF CONFORMAL COATING MATERIAL Final Report, 1 Jun. – 31 Dec. 1969
Samuel A. Glickman and Gerard G. Sonenstein Jan. 1970 62 p refs
(Contract NAS8-21336)
(NASA-CR-102743; RMD-5188-F) Avail: CFSTI CSCL 07D

Conformal coatings for electronic circuit boards and free films were obtained from a formulated solvent-based solution of gum CNR (tetrafluoroethylene, trifluoronitrosomethane, nitrosoperfluorobutyric acid gum terpolymer) reinforced with silica and cured with a diepoxide. These coatings displayed transparency, nonflammability, high strength, excellent vibration protection character among other satisfactory properties. Liquid carboxylic nitrosofluorocarbon polymers were obtained from trifluoronitrosomethane, tetrafluoroethylene, nitrosoperfluorobutyric acid terpolymerization modified by the joint use of chlorine and Freon 113 solvency. Diepoxide cured coatings were obtained with good promise for use in conformal coatings. Unsaturated terpolymers and carboxylic unsaturated tetrapolymers were prepared and oxidized to give liquid carboxylic nitrosofluorocarbon polymers. Cured films were obtained therefrom. Hydroxyl functioned nitrosofluorocarbon polymers were obtained by the reaction of ethylene oxide and a liquid carboxylic polymer. Cure with a fluorinated arylene diisocyanate was examined. Author

N70-31663*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN APPROACH TO CONTAMINATION IDENTIFICATION
Thomas R. Edwards 17 Apr. 1970 37 p refs
(NASA-TM-X-64506) Avail: CFSTI CSCL 07D

A regression analysis method was applied to unfold the waveforms resulting from complex gaseous mixtures in mass spectral analysis. The output format specifies both qualitative and quantitative chemical analysis. This method of data analysis is applied towards optical contamination identification in vacuum systems. A number of test mixtures are presented to demonstrate the feasibility of the technique. Author

N70-31671# Wien Univ. (Austria).
DYNAMICS OF LIQUIDS Final Scientific Report, 1 Nov. 1967 – 31 Oct. 1969
Peter Weinzierl 24 Jan. 1970 45 p refs
(Contract F61052-68-C-0018)
(AD-704129; AFOSR-70-0523TR) Avail: CFSTI CSCL 7/5

A new Mossbauer-spectrometer for transmission studies using the 46.5 keV transition in W-183 was designed and constructed. The lay-out of the system aimed at precision measurements of the Mossbauer-effect in the sample as a function of sample temperature up to 500C. Using waterfree Li2WO4 a series of measurements was carried out between 77K and 500K. The exponential decrease of the Mossbauer effect with temperature could be well fitted by

a straight line corresponding to a Debye-temperature of 173K. In preparation of a similar study of Fe-57 in In a first macroscopic determination of the diffusion constant for Fe in In was carried out using Fe-59 as tracer. Close to the melting point of In a value of D of the order of 10 to the -9th sq cm/s was obtained. An apparatus for small angle Rayleigh scattering of recoilless emitted quanta in liquids as a function of temperature was designed and partially tested. Searching for an extremely wide Mossbauer transition for test purposes the Mossbauer effect of the 125.3 keV transition in Re-185 was first observed. Author (TAB)

N70-31675 Polytechnic Inst. of Brooklyn, N.Y.
POLYMORPHIC TRANSFORMATIONS IN INORGANIC COMPOUNDS
Spero Manolatos (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-17795

Disorder in cesium thiocyanate and disorder in ammonium tetrafluoborate are studied. Cesium thiocyanate was selected for this investigation primarily because a transformation was observed, and because little has been reported concerning order-disorder transformations in crystals containing linear ions or molecules. The crystal structures of the orthohombic modification and high temperature cubic form were investigated by X-ray diffraction, calorimetry, and mircoscopy. The orthorhombic phase is ordered with four molecules per unit cell, a = 7.987A, b = 6.332A, and c = 8.332A. The structure is a layered one; two thiocyanate and two cesium ions lie on planes perpendicular to the b-axis at y = 1/4 and 3/4. Ammonium tetrafluoborate was selected for investigation because two distinct ionic groups are present, the ammonium and tetrafluoborate ions, each of which is capable of assuming many different orientations in the crystal. Ammonium tetrafluoborate crystallizes in the BaSO4 structure type; it is orthorhombic with four molecules per unit cell, and the space group is Pnma. The lattice constants are a = 9.059A, b = 5.663A, and c = 7.263A. Dissert. Abstr.

N70-31677 Washington State Univ., Pullman.
THE PREPARATION AND REACTIONS OF SOME GLYCINE COMPLEXES OF CHROMIUM (III)
Thomas William Kallen (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-3748

A mixed barium-potassium salt of the glycinato bis(oxalato) chromate (III) ion was prepared and characterized using ion-exchange chromatographic techniques and its visible absorption spectrum in aqueous solution at 25.0 C was reported. The aquation of the glycinato bis (oxalato) chromate(III) ion to the cis-bis(oxalato) diaquo chromate(III) ion was investigated using ion-exchange chromatographic techniques. The kinetics of the aquation of the glycinato bis (oxalato) chromate(III) ion were investigated spectrophotometrically at an isosbestic point of the intermediate and product species. The kinetics of substitution of oxalate for glycine in the glycinato bis (oxalato) chromate (III) complex were studied spectrophotometrically at a pH of 1.3, at total oxalate concentrations ranging from 0.10 M to 0.20 M, and at temperatures from 44.4 C to 55.8 C. Dissert. Abstr.

N70-31682 Virginia Univ., Charlottesville.
THEORY OF OPTICAL PROPERTIES OF AN EXCESS ELECTRON IN LIQUID HELIUM
Bruce William Du Vall (Ph.D. Thesis) 1968 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-3995

By using the bubble model, theoretical calculations of the Raman scattering cross-section can be performed in closed form. Calculations concerning optical absorption experiments and the excited bound states are also presented. These calculations make predictions that provide a stringent test of the validity of the bubble model. Dissert. Abstr.

N70-31731# Pitkin (Lucius), Inc., Grand Junction, Colo. Western Uranium Project.
HANDBOOK OF ANALYTICAL PROCEDURES
J. N. Latimer, W. E. Bush, L. J. Higgins, and R. S. Shay, comps.
16 Feb. 1970 291 p
(Contract AT(05-1)-912)
(RMO-3008) Avail: CFSTI

The handbook was compiled for use by the analysts in the laboratory of the USAEC Grand Junction Office, operated by Lucius Pitkin, Inc., as service contractor at Grand Junction, Colo. It is a composite of four earlier publications, RMO-3001; RMO-3001, Rev. No. 1; Supplement to RMO-3001, Rev. No. 1; and Supplement No. 2 to RMO-3001, Rev. No. 1. Alternate methods for analysis that are used as circumstance demands are included. The methods are listed in alphabetical order, according to element, in the table of contents. The procedures are presented in a simple and concise manner, but in sufficient detail to make them readily usable. Reference and acknowledgements are given in individual sections and procedures for further study, if desired. It is not inferred that the procedures in this manual are universal for any type of sample but have been found very reliable for the types of samples mentioned. NSA

N70-31742# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
STUDIES IN THE ISOTHIANAPHTHENE SERIES Final Report, 1 Sep. 1966 - 31 Aug. 1969
Michael P. Cava 27 Feb. 1970 15 p refs
(Grant DA-ARO(D)-31-124-G850)
(AD-703004; AROD-6440-4-C) Avail: CFSTI CSCL 7/3

In 1966 the author reported the discovery that the little known heterocycle isothianaphthene could be synthesized readily by the dehydration of an easily prepared sulfoxide. The principal objectives of the work described in the present report extend the sulfoxide dehydration reaction to the synthesis of other unusual but related sulfur heterocycles, and attempt the synthesis of various sulfones in the isothianaphthene series, especially in view of the fact that such compounds might be somewhat stabilized by an unusual type of sulfonyl conjugation. Author (TAB)

N70-31760# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON DERIVATIVES OF SUBSTITUTED PHENALENONES [UEBER DERIVATIVE SUBSTITUIERTER PHENALENONE]
Hans-Juergen Seidel (Ph.D. Thesis) 14 Jan. 1970 105 p refs
In GERMAN
Avail: CFSTI

Reactions of mono- and dialkoxy substituted phenalenones with trialkyloxonium-tetrafluorborates produced stable alkoxy-phenalenium cations. Heating of methoxy-phenalenones with pyrrolidino-acetate produced pyrrolidino-phenalenone and heating of methyl-phenalones with N,N-tetramethyleneformamide-diethylacetal resulted in N-pyrrolidino-vinyl-phenalenone with neutro-cyanine characteristics. Nucleophile substitution of alkoxygroups of the cationic system by radicals of nitrogen bases produced dye salts of the cyanine type. The carbon anion of the malodinitril eliminated only one of the substituents present (OR, NRsub2). Formylation of bis-pyrrolidino-phenalenium compounds resulted in electrophylic substitution with development of di- or trications. A theoretical MO-SCF model in PPP-approximation was used to evaluate the electron and proton resonance spectra of the described phenalenyl-cations. Transl. by G.G.

N70-31888 University of Southern Calif., Los Angeles.
PHASE BEHAVIOR IN A MULTICOMPONENT HETEROAZEOTROPIC SYSTEM
Kenneth Earl Hayworth (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-19372

The effects of water are investigated on a multicomponent hydrocarbon system of known composition. To study the ternary system of benzene-cyclohexane-water, thirty-five samples were prepared. The pressure at the liquid and vapor phase boundaries of these samples were determined within the temperature range from 150 to 300 C. Along with a complete numerical tabulation these data are presented graphically as pressure-temperature, temperature-composition, and pressure-composition diagrams. The loci of the vapor critical points, maximum water solubility, and heteroazeotropic composition are shown to indicate the shape of the surface for each of these phenomena of the system, as well as the critical vapor locus of the hydrocarbon mixtures and the vaporization critical endpoint locus of the hydrocarbon-water mixtures. Dissert. Abstr.

N70-31864# Mound Lab., Miamisburg, Ohio.
SOLVENT EXTRACTION OF POLONIUM INTO THE ORGANIC PHASE FOR ANALYTICAL APPLICATIONS: A REVIEW
C. T. Bishop 20 Mar. 1970 13 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1721) Avail: CFSTI

Separation of polonium by solvent extraction into an organic phase is reviewed. Data on 32 extraction systems including phosphates, amines, chelating agents, ethers, ketones and alcohols are summarized in tabular form. The composition of the aqueous and organic phases, the elements extracted into the organic phase and those remaining in the aqueous phase, and reference are given. Distribution ratios or percentage extraction data are also given where these quantities were determined. Author (NSA)

N70-31865# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.
REACTIONS OF IODINE VAPOR WITH ORGANIC PAINT COATINGS
R. L. Bennett, Ruth Slusher, and R. E. Adams Apr. 1970 21 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2760) Avail: CFSTI

An investigation of the reaction of elemental iodine with some paints of interest in the nuclear safety program was conducted. Amercoat 66 and Phenoline 302 paint systems were studied with primary emphasis on the former. Methyl iodide and higher members of the homologous series were produced by the reaction of iodine vapor with either of the two paint systems. As the temperature of the reaction system was increased, the amount of methyl found in the reaction vessel increased significantly. The yield of organic iodides was not significantly changed by the presence of water (100% relative humidity) or hydrogen (0.5%). From the flame ionization chromatographs it was evident that large amounts of organic compounds baked out of the coating on heating. A test simulating an aged coating was conducted by sweeping a heated vessel with nitrogen for one week. While ethyl iodide production was strongly dependent on the concentration of vapors baked from that paint surface, methyl iodide formation was not greatly reduced by removal of the vapors. Author (NSA)

N70-31879# Aerochem Research Labs., Inc., Princeton, N.J.
KINETIC STUDIES OF THE ATTACK OF REFRACTORY MATERIALS BY FLUORINE ATOMS Final Report, 1 Feb. 1969 - 31 Jan. 1970
Daniel E. Rosner and Donald H. Allendorf Jan. 1970 28 p refs
(Contract DA-31-124-ARO(D)-429)
(AD-703881; Aerochem-TP-233) Avail: CFSTI CSCL 7/4

The true kinetics of the attack of molybdenum and tungsten surfaces by both atomic and diatomic fluorine were studied using microwave charge--fast flow vacuum system techniques coupled with electrical resistance heating of the reacting specimens. Experimental results are reported herein covering the surface temperature range from 700K to their respective thresholds. Exploratory kinetic data is also included for the fluorination of titanium, graphic and boron. It is shown that despite the well known reactivity of molecular fluorine, dissociation produces a striking enhancement in the Mo- or W-atom removal probability at surface temperatures corresponding to appreciable steady state adatom populations. Interestingly enough, multiple local maxima appear in the Arrhenius diagram for the F-atom attack of Mo(s) and W(s)--these maxima presumably being attributable to the formation/desorption of distinct metal fluorides of widely discrepant stiochiometry and thermodynamic stability. Author (TAB)

N70-31895 Louisiana State Univ., New Orleans.
A MOLECULAR ORBITAL STUDY OF THE COPPER (II) CHLORIDES
Eleanor Shafer Elder (Ph.D. Thesis) 1969 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-18524

The copper (2) chlorides exist in a wider variety of geometrical forms than do complexes of any other metal with a single ligand, but are not found in the regular tetrahedral and octahedral geometries common to so many other transition metals. They are found in distorted tetrahedron in $Cs_2[CuCl_4]$, in a square planar arrangement in $(NH_4)_2[CuCl_4]$, in a distorted octahedral arrangement is $CsCuCl_3$ and $CuCl_2$, in a trigonal bipyramid in $[Cr(NH_3)_6][CuCl_5]$, and most probably linear in gaseous $CuCl_2$. A modified Mulliken - Wolfsberg - Helmholz approach was used to calculate the energy levels and ground state wave functions for these complexes. Group overlaps were calculated from the exact geometry of the complexes. Spectral correlations were made with existing experimental data, and g-values calculated and obtained from ESR data. Reasonable agreement was obtained in most cases. It is believed that the most important aspect of the study is that for the first time a consistent molecular orbital study has been made on a series of complexes having varying geometries but the same metal and ligand atoms. The correlation of theoretical results with experiment is at least as good as that obtained with any other theoretical study. Consequently the method of computation was tested and found to be satisfactory. Dissert. Abstr.

N70-31930 Michigan State Univ., East Lansing.
AN INVESTIGATION OF THE CERIUM OXYGEN NITROGEN SYSTEM
Kenneth James Manske (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-20888

The cerium oxygen nitrogen ternary phase diagram was partially characterized from an examination of X-ray powder diffraction data of samples with various cerium oxygen nitrogen compositions. These samples were prepared by arc melting cerium dioxide and nitride, which was also prepared by the arc melting process. X-ray powder diffraction patterns and micrographic examinations reveal the presence of four phases: cerium sesquioxide, cerium nitride, cerium metal, and a previously unreported cerium oxide nitride. The properties of this oxide nitride are discussed in comparison with those of other metal oxide nitride phases. Dissert. Abstr.

N70-31932 State Univ. of New York at Buffalo.
A STUDY OF THE STRUCTURE AND REACTIVITY OF SEVERAL METAL-EDTA-LIKE COMPLEXES
Robert Emil Yelin (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-20520

The structure and reactivity of Co(II)-EDTA, Co(II)-HEDTA, Co(II)-CyDTA and Co(III)-CyDTA complexes in solution have been determined. Co(II)-EDTA and Co(II)-CyDTA are found to contain 6-coordinate ligand and are more reactive with common oxidants than the respective protonated quinquedentate complexes. Co(II)-HEDTA contains 5-coordinate ligand in solution and due to its structure is more reactive than Co(II)-EDTA with the inner-sphere oxidant.

Mn(CyDTA)OH(2). A kinetic investigation of the monomer-dimer equilibriums for the Fe(III)-HEDTA and Fe(III)-EDTA systems has been carried out. A mechanism is proposed which explains the pH dependence of the formation and dissociation of the dimers. The dimers are formed from two hydrolyzed monomers, as well as from the combination of a hydrolyzed monomer with an unhydrolyzed monomer. The decomposition of the dimers occurs by both a water-assisted and an acid-catalyzed path. Author

N70-31939 Carnegie-Mellon Univ., Pittsburgh, Pa.
KINETICS OF ZINC OXIDE REDUCTION WITH CARBON MONOXIDE
Charles E. Guger, Jr. (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-19094

The rate of reduction of zinc oxide single particles with carbon monoxide was investigated at atmospheric pressure over the temperature range 1000 C to 1500 C. Weight loss data up to about 90% reduction were obtained for both American and photoconductive grade zinc oxide samples. The porosity of the photoconductive grade specimens was essentially zero, whereas the American grade material had a porosity of about 13%. Single particle reproducibility was achieved with the photoconductive grade zinc oxide but not with the American grade samples, whose scatter was attributed to residual porosity and impurities. The experimental results were interpreted in terms of a mixed regime model, which pictures an external diffusion process acting in series with an irreversible first order kinetic process at the surface. For the photoconductive grade zinc oxide, the mixed regime model gave a good fit over the entire temperature range from 1000 C to 1500 C. Diffusional limitations were approached at 1500 C. Dissert. Abstr.

N70-31950 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF CATHODIC POLARIZATION DURING SIMULTANEOUS DISCHARGE OF NICKEL AND ZINC IONS IN SULPHATE SOLUTIONS
L. V. Volkov et al 20 Apr. 1970 10 p refs Transl. into ENGLISH from Elektrokhimiya (Moscow), v. 5, no. 10, Oct. 1969 p 1143-1147 In ENGLISH and RUSSIAN
(NLL-Trans-746-444-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

To explain the causes of superpolarization, potential and time curves with and without cathodic polarization were studied according to the usual method for this type of measurement. Oscillographs were obtained for a nickel electrode in 1 N NiSO4 solution containing different amounts of ZnSO4 at pH 4 and 60 deg C. The compositions of the solutions are shown as well as the zinc concentration in the electrodeposit formed on the cathode at corresponding current densities. It was found that the oscillographs depend on the zinc concentration in the electrolyte as do the polarization curves. The potential of the electrode without the polarizing current almost instantaneously falls to the commencing values in the electrolyte containing less than 0.01 g-equ/1 zinc. It is concluded that the superpolarization for nickel during its simultaneous discharge with zinc is determined by the inhibiting effect of the electrode on the rate of the process. Author

N70-31960 National Lending Library for Science and Technology, Boston Spa (England).
SIMULTANEOUS DISCHARGE OF MOLYBDENUM AND RHENIUM IMPURITIES WITH NICKEL AND COBALT
G. R. Pobedimskii et al 20 Apr. 1970 10 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (USSR), v. 42, no. 7, Jul. 1969 p 1516-1520 In ENGLISH and RUSSIAN
(NLL-Trans-461-372-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A qualitative verification is given of the theory of simultaneous ion discharge of the base metal and a metal mixture discharging in a limited current; for example, the inclusions of rhenium and molybdenum in the cathodic deposit of nickel and cobalt. It was established that molybdenum and rhenium, in the form of a mixture, discharge at a limiting current during electrolysis of the metal from ammonium-citrate and sulphate electrolytes. The general laws of behavior of the mixture from the anion complex is subordinated to the requirements of an equation derived for the mixture cations. Author

N70-31973# National Lead Co. of Ohio, Cincinnati.
ATOMIC ABSORPTION METHODS FOR THE DETERMINATION OF MICROGRAM QUANTITIES OF RUTHENIUM IN URANIUM MATERIALS AND OF ZIRCONIUM IN URANIUM AND THORIUM MATRICES
M. L. Jursik 20 Aug. 1969 24 p refs Presented at 13th Conf. on Anal. Chem. in Nucl. Technol., Gatlinburg, Tenn., 30 Sep.-2 Oct. 1969 Sponsored by AEC
(NLCO-1047; CONF-690942-1) Avail: CFSTI

A ruthenium bearing uranium sample is dissolved by heating with concentrated perchloric acid in a distillation apparatus. The ruthenium is oxidized to the volatile Ru(8+) by fuming and is simultaneously distilled into an ice cooled receiver. The distillate is aspirated into an air - acetylene flame, and the absorption is read at 3499 A. The ruthenium calibration curve is a straight line in the range of 0 to 5 micrograms ruthenium per ml. Sensitivity is 0.3 micrograms ruthenium per ml per 1% absorption. A zirconium bearing uranium or thorium sample is dissolved in 7 M hydrochloric acid and extracted with TTA - xylene. The organic phase is aspirated into the nitrous oxide - acetylene flame. The zirconium calibration curve is a straight line in the range of 0 to 50 micrograms zirconium per ml. The principal interferences are from fluoride, phosphate, and sulfate ions, but at levels above those usually found in metallic samples. Sensitivity is 1 micrograms zirconium per ml per 1% absorption. Author (NSA)

N70-31976 Minnesota Univ., Minneapolis.
SOME PROBLEMS IN THE ANALYSIS OF CHEMICAL SYSTEMS WITH STOCHASTIC FEATURES
Thomas Michael Pell, Jr. (Ph.D. Thesis) 1969 222 p
Avail: Univ. Microfilm: HC $10.15/Microfilm $3.00 Order No. 69-20046

Systems of linear equations with random (white noise) coefficients are examined and applied to a simple reaction system in both batch and stirred tank reactors with rapidly fluctuating conditions. The optimum reaction time in the batch and holding time in the stirred tank is calculated as a function of the kinetic parameters and the intensity of the random fluctuations in temperature and flow rate. Some aspects of filtering and parameter identification are considered. Considerations involved in the selection of exact versus approximate techniques are discussed, and an approximate nonlinear filter obtained by linearizing the nonlinear system about the present estimates and applying the Kalman filter is tested and compared to the results of an exact least-squares technique. Dissert. Abstr.

N70-31981 Louisville Univ., Ky.
KINETICS OF THE LOW TEMPERATURE WATER-GAS SHIFT REACTION
William Thomas McDonald (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-17636

The water gas reaction with a low temperature shift catalyst was studied and an overall chemical reaction model was formulated. The model was based on the Langmuir-Hinshelwood steps of external and internal mass transfer coupled with the chemical reaction mechanism. The apparatus used in this research was a 3/4 in diameter stainless steel reactor with a catalyst bed depth of 7

in. A feed gas stream of measured rate was mixed with a metered water stream and the water vaporized in a furnace preheater. From the preheater, the gas mixture flowed to the reactor which was temperature controlled by a heated Dowtherm jacket. The exit product gas went to a condenser and water knock-out pot. The exit gas stream from the pot was analyzed by a chromatograph for CO and by an Orsat apparatus for CO2. Dissert. Abstr.

N70-31985# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOSPECTROSCOPIC AND QUANTUM-CHEMICAL METHODS IN STRUCTURAL STUDIES (COLLECTION OF ARTICLES)
M. V. Bazilevskii 28 Jan. 1970 38 p refs Transl. into ENGLISH from the Publ. "Radiospekroskopicheskie i Kvantokhimeskin Metody v Strukturnykh Issledovaniyakh (Sbornic Statei)" Moscow, Nauka, 1967 p 40–49, 50–58
(AD-704197; FTD-MT-24-360-69) Avail: CFSTI CSCL 7/4

Contents: Use of a method of molecular orbitals for calculation of activation energy. II. Reaction Ch2 = CH2 + CH3; and The use of a method of molecular orbitals for calculation of activation energy. III. Method of the energy of stabilization. TAB

N70-31991*# Westinghouse Research Labs., Pittsburgh, Pa.
SYNTHESIS OF PYRRONE POLYMERS
L. W. Frost and G. M. Bower Washington NASA Jun. 1970 97 p refs
(Contract NAS1-7354)
(NASA-CR-1556) Avail: CFSTI CSCL 07C

Several methods were found to control the gelation problem encountered in preparing pyrrones from dianhydrides and tetramines in polar solvents. Addition of a tertiary amine increased shelf life and attainable solids. Similar improvement was found when ortho-chloro groups were used for steric deactivation of two amine groups. Complete elimination of the gel problem was achieved by blocking two amine groups with acetyl or carbethoxy groups. Low molecular weight "salt" intermediates made from diester diacids and tetramines were also relatively free from gelation problems. A two-solution system for preparing pyrrone-imide copolymers provided another way to avoid gelation. Infrared and TGA studies showed that thermal curing gave good conversion to pyrrone only from dianhydride-tetramine polymers. Both blocked amine and salt types gave other structures, some of which were probably crosslinked. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-30645# Boeing Scientific Research Labs., Seattle, Wash.
DIFFRACTION OF VLF WAVES BY THE MOON
Don P. Gia Russo Dec. 1969 26 p refs
(AD-703006; D1-82-0939) Avail: CFSTI CSCL 17/2.1

The diffracted field of a VLF source located in the presence of a lossy dielectric sphere imbedded in an isotropic plasma is investigated. The results show an increase in diffracted energy as the source frequency approaches the plasma frequency. A quantitative description of the field near and at the antipode of the source is given. Author (TAB)

N70-30684# Institute for Telecommunication Sciences, Boulder, Colo.
POWER GAINS FOR ANTENNAS OVER LOSSY PLANE GROUND
M. T. Ma and L. C. Walters Apr. 1969 71 p refs
(ESSA-TR-ERL-104-ITS-74) Avail: SOD $0.65

Theoretical power-gain formulas for 13 different antenna models above a flat homogenous lossy ground are derived in terms of frequency, antenna geometries, and ground constants. The radiation resistance required in the formulation is calculated with an assumed sinusoidal current distribution. Author

N70-30692*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
AN EXPERIMENTAL STUDY OF VLF MODE COUPLING AND POLARIZATION REVERSAL
Paul Rodriquez and Donald A. Gurnett Mar. 1970 37 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150; Grant NGR-16-001-043 et al Contract N00014-68-A-0196-0003)
(NASA-CR-110460; Rept-70-23) Avail: CFSTI CSCL 20N

An experimental study of polarization reversal and mode coupling of electron and proton whistlers is presented. The occurrence of polarization reversal for a whistler signal observed in the ionosphere is indicated by the presence of a proton whistler. Mode coupling between the right and left hand modes of propagation is indicated by the occurrence of both electron and proton whistler signals at the same frequency. Mode coupling is observed to occur most frequently over a range of about 35 deg - 55 deg magnetic latitude. Below about 35 deg magnetic latitude, polarization reversal is the predominant effect, whereas above about 55 deg magnetic latitude neither mode coupling nor polarization reversal occur and proton whistlers are not observed. These results are compared with existing theories to explain this latitude dependence. Author

N70-30808*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-61, VOLUME 2 FOR THE PERIOD 1 NOVEMBER – 31 DECEMBER 1969. THE DEEP SPACE NETWORK
31 Jan. 1970 170 p refs
(Contract NAS7-100)
(NASA-CR-110434; JPL-SPS-37-61-Vol-2) Copyright. Avail: CFSTI CSCL 17B

CONTENTS:

1. INTRODUCTION p 1–7 (See N70-30809 16-07)
2. MISSION SUPPORT p 8–30 refs (See N70-30810 16-07)
3. ADVANCED ENGINEERING p 31–107 refs (See N70-30811 16-07)
4. DEVELOPMENT AND IMPLEMENTATION p 108–152 ref (See N70-30812 16-07)
5. OPERATIONS AND FACILITIES p 153–158 ref (See N70-30813 16-07)

N70-30809*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTRODUCTION
In its Space Programs Sum. No. 37-61, vol. 2 31 Jan. 1970 p 1–7 (See N70-30808 16-07)
Copyright. Avail: CFSTI CSCL 17B

The Deep Space Network (DSN) which is designed for two-way communications with unmanned spacecraft traveling to planetary distances is analyzed. The DSN is shown to be concerned with metric, telemetric, and command data. The facilities include: (1) tracking and data acquisition facilities, (2) compatibility testing facilities, (3) ground communications facility, and (4) space flight operations facility. A description of the simulation system is included. F.O.S.

N70-30810*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION SUPPORT
In its Space Programs Sum. No. 37-61, Vol. 2 31 Jan. 1970 p 8-30 refs (See N70-30808 16-07)
Copyright. Avail: CFSTI CSCL 17B

The preparations made for DSN tracking and data acquisition for support of Pioneer E are described, and the support provided Pioneer 6, 7, 8, and 9 is summarized. The Pioneer F and G mission designs are discussed. Other planetary flight projects supported include: Mariner Mars 1969, simulation of Mariner Mars 1971, Apollo 12, Viking, and Hekios mission support. F.O.S.

N70-30811*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED ENGINEERING
In its Space Programs Sum. no. 37-61, Vol. 2 31 Jan. 1970 p 31-107 refs (See N70-30808 16-07)
Copyright. Avail: CFSTI CSCL 17B

The determination and verification of the accuracy of the DSN as a radio navigation instrument for lunar and planetary missions are analyzed for the formulation of designs and plans for refining this accuracy to its practical limits. A set of orbital design philosophies which maximize the capability for estimating the spacecraft state is defined. Recent work on the lunar surface mass distribution is discussed, and a map of the Humorum area is presented with contours in intervals of 10 mgal using the line-of-sight- accelerations from Lunar Orbiter 5 doppler tracking data. The tracking data gained from the Apollo 12 lunar module, during the descent trajectory, indicated large negative accelerations over the craters Ptolemeus and Albategnius. The mass deficiencies required to produce these accelerations are equated to the removal of the surface material to the depth of approximately one km. Other features of the gravity fine structure are correlated with topography. Research in digital acquisition and detection, and design and implementation of a threshold data compression system is reported. F.O.S.

N70-30812*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND IMPLEMENTATION
In its Space Programs Sum. No. 37-61, Vol. 2 31 Jan. 1970 p 108-152 ref (See N70-30808 16-07)
Copyright. Avail: CFSTI CSCL 17B

The research and developments in the Deep Space Stations (DSS) are reported. Some of the topics discussed include: winterization of the time sync master station, modification of the 210 ft diam antenna at DSS 14 by the installation of a multiple feed cassegrain feed system, drive amplifier for the 400 kW klystron, effect of noise on phase-lock receiver performance, and DSn projects and systems development. F.O.S.

N70-30813*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATIONS AND FACILITIES
In its Space Programs Sum. No. 37-61, Vol. 2 31 Jan. 1970 p 153-158 ref (See N70-30808 16-07)
Copyright. Avail: CFSTI CSCL 17B

The operational activities of the DSN are reported. Included are the operational procedures for the space flight operations facility, and the deep space instrumentation facilities. F.O.S.

N70-30826# National Physical Lab., New Delhi (India). Radio Propagation Unit.
IONOSPHERIC PREDICTIONS FOR JUNE 1970
Feb. 1970 4 p Prepared for Council of Sci. and Ind. Res.
(RRC-B165) Avail: CFSTI

Graphs of predicted median for 2 values and predicted median MUF(4000)F 2 values are presented, along with a nomogram for transforming F 2-zero-MUF and F 2-4000-MUF to equivalent maximum usable frequencies at intermediate transmission distances.
Author

N70-30830*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EQUATORIAL SCINTILLATIONS EXPERIENCED DURING APOLLO 11 SUPPORT, 12-24 JULY 1969
George K. Kuegler Sep. 1969 47 p refs
(NASA-TM-X-63944; X-460-69-534) Avail: CFSTI CSCL 17B

The ATS-1 VHF transponder was used as a communication link between ships of the Apollo 11 task force and the U.S. mainland from July 12 to 24. During 13 days of testing, several fading and changes in apparent angle of arrival of signals were experienced. The fading is attributed to equatorial scintillations, but the changes in the apparent angle of arrival are difficult to account for. Some changes can be attributed to the effects of the ship's structure on the antenna radiation patterns, but it does not account for all the changes. Tables of the angle of arrival data are presented along with charts of the signal levels recorded during the test period. Author

N70-30832# Physics Lab. RVO-TNO, The Hague (Netherlands).
DOPPLER FILTERS FOR A CW SONAR RECEIVER WITH A MIXED REVERBERATION AND NOISE BACKGROUND [DOPPLERFILTERS VOOR EEN CW SONARONTVANGER BIJ GEMENGDE REVERBERATION-RUISSTORING]
C. van Schooneveld Jul. 1969 20 p refs In DUTCH; ENGLISH summary
(PHL-1969-17; TDCK-55085) Avail: CFSTI

The optimum frequency transfer function for the doppler filters of a CW sonar receiver is considered. The random background signal, interfering with the echo detection, consists of a frequency independent noise component and a strongly frequency dependent reverberation component. Therefore, the optimum doppler filters are matched to the expected echo as well as to the spectral structure of the interference, contrary to filters which take only the expected echo into account. The use of properly mismatched filters appears to promise a great gain in detection performance. For transmitted sonar pulses with widely spread spectra (e.g. pulse with rectangular envelope), the gain is expected in all doppler channels. For pulses with narrow, concentrated spectra (e.g. pulse with smooth envelope), the gain is concentrated in a few of the central doppler channels. Author

N70-30840# Advisory Group for Aerospace Research and Development, Paris (France).
COMMUNICATION
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 63-69 (See N70-30833 16-21)
Avail: CFSTI

Communication implies the sending, transmitting and receiving of information. Most studies of communication problems in ground control systems have been concerned with voice messages. The intelligibility of such messages is affected by the transmission channel, by the choice and enunciation of words, and by the sequence in which information in the message is given. There are individual differences in the ability to send and receive voice messages and aspects of the task, such as its design and the operator's workload, affect voice communication. A task which relies heavily on verbal communication with others may be less efficient than one in which the operator can work autonomously, and communication at all levels of a system tends to increase if a crisis occurs. Little human factors work has been done on co-ordination in ground control systems. Author

N70-30993# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A TROPOSPHERIC RADIO RELAY COMMUNICATION ANTENNA
B. S. Nadenenko 9 Jan. 1970 12 p refs Transl. into ENGLISH from Elektrosvyaz (Moscow), v. 23, no. 4, 1969 p 14-21
(AD-702972; FTD-HT-23-10-70) Avail: CFSTI CSCL 17/2

Most commonly employed abroad as trophospheric radio relay communication antennas in the band of approximately 30 cm are antennas with an axiosymmetrical parabolic reflector. The parabolic antenna with remote primary radiating element (exciter) which has been developed in our country offers a number of advantages over the axio-symmetrical antenna. In the asymmetrically excited antenna there is practically no mirror reaction associated with the propagation, in the transmission line, of an electromagnetic wave reflected by the parabolic reflector and received by the exciter. By locating the radiating element and its securing structures at the focal point of the axio-symmetrical reflector, a portion of the antennas aperture surface is shaded. This leads to some decreases in the energy radiated toward the correspondent and to an increase in side lobe levels. Along with its better electrical parameters, the antenna with asymmetrical reflector illumination provides for location of exciter and transmission lines on the surface of the ground, thus facilitating installation, adjustment and operation. An additional important advantage is the oblique disposition of the reflectors working surface with respect to the ground. This rules out any possibility of snow or frost accumulations and eliminates the need for any screening of the antenna. TAB

N70-30995# National Physical Lab., New Delhi (India). Radio Propagation Unit.

IONOSPHERIC PREDICTIONS FOR MAY 1970

Feb. 1970 4 p

(RRC-B164) Avail: CFSTI

Graphs of predicted median foF 2 values and predicted median MUF(4000)F 2 values are presented, along with a nomogram for transforming F 2-zero-MUF and F 2-4000-MUF to equivalent maximum usable frequencies at intermediate transmission distances. Y.M.

N70-31168# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

VOWEL SPECTRA, VOWEL SPACES AND VOWEL IDENTIFICATION

W. Klein, R. Plomp, and L. C. W. Pols 1970 38 p refs

(IZF-1970-6; TDCK-55425) Avail: CFSTI

Twelve Dutch vowels, each pronounced by 50 male speakers, were analyzed in 18 filter bands comparable in bandwidth with the ear's critical band. Considering the sound levels (in dB) in these filter bands as dimensions, with a principal-component analysis the 18 dimensions per sound were reduced to 4 factors explaining together 75% of the total variance. The configuration of the average vowels in the factor space appeared to be highly correlated with their configuration in the F sub 1 - F sub 2 formant plane. After matching to maximal congruence, correlation coefficients along corresponding axes were 0.997 and 0.979. Machine vowel identification, based upon the position of the individual vowels in the 4-dimensional factor space, resulted in 98% correct identifications if correction was applied for personal timbre of the speakers' voices. Ten listeners, to whom the 600 vowels were presented as 100-msec segments, gave 86% correct responses in identifying the intended vowels. In 4 dimensions the solution showed 2.3% stress. Perceptual configuration and factor configuration, maximally matched, had correlation coefficients along corresponding axes of 0.997, 0.995, 0.907 and 0.794, respectively. Author

N70-31272# Siemens A.G., Munich (West Germany).

COMMUNICATIONS SATELLITE. VOL. 3: MICROWAVE ANTENNAS FOR COMMUNICATIONS SATELLITES [NACHRICHTENSATELLIT. BAND 3: MIKROWELLENANTENNEN FUER NACHRICHTENSATELLITEN]

W. Rebhan Apr. 1970 83 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-70-14) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 17,20 DM

Metallic and dielectric horn radiators were experimentally tested for their suitability as earth-coverage antennas for synchronous satellites. With radiators of relatively simple design and conical directional pattern, a radiation gain of 16 - 17 dB could be attained in the direction towards the rim of the earth. For such transmission of the 4-GHz and 6-GHz radio relay bands, circular metallic multi-mode horns gave the best values; their rim gain was 17 dB within a bandwidth of about + or - 6%. Author (ESRO)

N70-31297# Institute of Technology, Helsinki (Finland). Radio Lab.

A 136 MHz ANTENNA SYSTEM FOR AUTOMATIC TRACKING

Seppo Urpo 1969 14 p refs

(Rept-S-26-1969) Avail: CFSTI

An automatic satellite tracking antenna system consisting of a group of four crossed Yagi antennas is described. Electronic scanning was accomplished by switching phase shifting coaxial cables to every antenna. The electronic switching is carried out with new diode switches which have low attenuation and are well matched to the impedances of the antennas and transmission line. The operating frequency range is 136 - 138 MHz and the tracking accuracy is about 1 deg. Author (ESRO)

N70-31309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES

I. A. Vasilyeva et al 19 Jan. 1970 41 p refs Transl. into ENGLISH from Tekhn. Kina i Televideniya (Moscow), no. 5, 1967 p 39 - 47, 74 - 78

(AD-704049; FTD-MT-24-366-69) Avail: CFSTI CSCL 17/2

Contents: High-quality image orthicon LI-213; Video amplifier with combined compensation; Photometric analysis of the flying-spot photoelectric converter; and High-speed transistorized switching. TAB

N70-31318# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES

V. B. Ivanov et al 27 Feb. 1970 53 p refs Transl. into ENGLISH frm Tekhn. Kina i Televideniya (Moscow), no. 4, 1969 p 13 - 18, 53 - 62

(AD-704289; FTD-MT-24-349-69) Avail: CFSTI CSCL 17/2

Contents: The small size video tape recorder Malakhit; LI-218 image orthicon; Measurement of television channels in the color subcarrier region; The LI-415 vidicons under conditions of microsecond illuminations; and Television method of measuring the speed of movement. TAB

N70-31337# General Instrument Corp., Hicksville, N.Y. Electronic Systems Div.

RADAR SET AN/PPS-( ): FAILURE FREE DEVELOPMENT PROGRAM Interim Development Report, 3 Nov. 1969 - 28 Feb. 1970

Earl L. Chatterton 28 Feb. 1970 28 p

(Contract N00039-70-C-3501)

(AD-704148; ESD-1158-IR-1) Avail: CFSTI CSCL 17/9

The report covers the initial period of Phase II of a program to design, manufacture, and test 20 high reliability versions of the AN/PPS-6 battlefield surveillance radar. The report covers the period of project organization and start up and the initial design of the developmental breadboards. Breadboards for all of the critical areas have been designed and tests have been conducted on all critical electronic circuitry with the exception of the transmitter. No inherent design problems have been uncovered to date. Author (TAB)

N70-31340# Mitre Corp., Bedford, Mass.
EQUALIZATION STUDIES FOR THE PAM DIGITAL MODEM
Allen E. Post Mar. 1970 50 p refs Revised
(Contract F19628-68-C-0365)
(AD-704137; MTR-1728; ESD-TR-70-29) Avail: CFSTI CSCL 17/2

The report reviews the present state-of-the-art techniques of narrowband (4 KHz) wireline equalization for PAM signals. Two basic minimization techniques are discussed. Related derivations and proofs are included. Author (TAB)

N70-31380# Rome Air Development Center, Griffiss AFB, N.Y.
A TIME-SHARING SCHEME FOR ALLEVIATING INTERFERENCE IN COLLOCATED RADIO EQUIPMENTS
John Frank Spina Mar. 1970 144 p refs
(AD-703704; RADC-TR-69-372) Avail: CFSTI CSCL 17/2

The need to locate several radio transmitters and receivers in close proximity due to space limitations and yet be able to operate them simultaneously introduces severe interference. The purpose of the report is to discuss the feasibility of using a time-sharing approach to alleviate or eliminate some of these problems. The central idea to be investigated is the concept of a switching arrangement such that individual equipments take turns in performing their designated function. That is, at any instant of time, only one equipment (transmitter or receiver) in the complex is communicating. The switching must be done at a rate such that no loss of information occurs. This switching rate is specified by the sampling theorem, where the rate is a function of the highest frequency component in the message. Attention is focused on the method of switching or sampling, with particular emphasis on the shape of the sampling signal. The trade-offs in terms of spectrum width, signal level, and numbers of equipments to be handled are examined for several sampling pulse shapes. Author (TAB)

N70-31495# Tracor, Inc., Rockville, Md.
DATOM/SIMM COMPARATIVE ANALYSIS Final Report, Sep. 1968 - Dec. 1969
W. R. Atchley, D. L. Glazer, and W. C. Johnson 15 Dec. 1969 72 p refs
(Contract N00024-69-C-1051)
(AD-704169; Rept-69-1052-U) Avail: CFSTI CSCL 17/1

An experimental evaluation was performed to determine differences, if any, between the DATOM and SIMM technical manuals when used as a sonar equipment maintenance aid. The experiment was structured to require solution of thirteen maintenance problems varying in difficulty, performed on sonars for which preliminary DATOM and final SIMM technical manuals exist. The experimental data allowed comparison of Navy sonar technician trainee performance in time-to-solution and in correct determination of intentionally faulted sonar subassemblies, while using the respective technical manuals as an aid. Author (TAB)

N70-31501*# Auburn Univ., Ala. Amplifying Systems Lab.
DESIGN AND CONSTRUCTION OF A PULSE-WIDTH-MODULATED SIGNAL GENERATOR. PART 1 Annual Report
M. A. Honnell 20 Mar. 1970 83 p refs
(Contract NAS8-11344)
(NASA-CR-102746) Avail: CFSTI CSCL 09E

The programmable pulse-width modulated signal generator described was designed and constructed to serve as a versatile source of various types of pulse-width-modulated signals. Typical signals generated are unipolar and bipolar PWM signals with single-edge, or double-edge, modulation. This signal generator can be used as a driver for the development of PWM power amplifiers, or as a source of PWM signals for studies of their spectral content and of filter requirements for low-distortion signal recovery. The basic characteristics of unipolar and bipolar PWM amplifiers and signals are discussed. The signal generator incorporates an active low-pass filter with a Butterworth characteristic having a roll-off of 6, 12 and 18 db per octave. The system is conveniently arranged for the application of negative feedback to assist in stability studies and to study the effect of negative feedback on signal distortion and on carrier ripple. The unfiltered carrier output signal can supply 200mA to a 50-ohm load which is sufficient to drive high power switching mode output amplifier stages. Author

N70-31511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES
I. V. Ruzanov et al 19 Feb. 1970 69 p refs Transl. into ENGLISH from Tekhn. Kina i Televideniya (Moscow), no. 11, 1967 p 19-30, 46-59
(AD-703883; FTD-MT-24-372-69) Avail: CFSTI CSCL 17/2

Contents: Magnetic videorecording in the USSR; Systems of applied television and television automaton; Gradational characteristics of negative and positive films; and A color image receiver on a kinescope with focusing grid. TAB

N70-31533# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
VLF EMISSIONS AND ELECTRON INSTABILITIES, JUNE 1968 - JUNE 1969
John M. Cornwall 1 Dec. 1969 21 p refs
(Contract F04701-69-C-0066)
(AD-703709; TR-0066(5260-12)-12; SAMSO-TR-70-108) Avail: CFSTI CSCL 4/1

Current research into VLF emissions and the electron instabilities which cause them are reviewed in this report. Data have been gathered by OGO 1, 3, and 5 that have led to the identification of a type of narrow bandwidth chorus, now called banded chorus. Purely electrostatic modes have also been seen and studied in detail, especially on OGO 5. Observation of triggered emissions and the nonlinear theories invoked to explain the emissions are included. Author (TAB)

N70-31559# Naval Research Lab., Washington, D.C.
DETECTION RESULTS FOR SCANNING RADARS EMPLOYING FEEDBACK INTEGRATION Interim Report
G. V. Trunk 3 Mar. 1970 16 p refs
(AD-704091; NRL-7031) Avail: CFSTI CSCL 17/9

A method was devised for calculating the detection probabilities for a scanning radar employing feedback integration. The optimal value of K, the feedback value, is determined by equating 1/(1-K), the equivalent number of pulses integrated, to 63% of the number of pulses between the 3-dB points of the scanning antenna. This expression holds for small- and large-sample sizes and for fluctuating and nonfluctuating targets. Then, by subtracting an antenna beam-shape factor of 0.3 dB from the midbeam signal-to-noise ratio, one can use the standard detection curves to find the probability of detecting a target as it passes through the beam. The beam-shape factor differs from 0.3 dB by less than 0.2 dB for small-sample sizes. Author (TAB)

N70-31560# Naval Research Lab., Washington, D.C.
A REVIEW OF NARROWBAND AMBIGUITY FUNCTIONS Interim Report
D. A. Swick 27 Feb. 1970 38 p refs
(AD-704070; NRL-7007) Avail: CFSTI CSCL 17/1

The narrowband ambiguity function has been used to study the space-time resolution of radar and sonar signals. Its derivation, properties, and generalizations are reviewed in a unifying notation. A most general ambiguity function is defined, from which both narrowband and wideband ambiguity functions can be derived. Author (TAB)

N70-31567# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
SOURCE ENCODING FOR GOOD QUALITY SPEECH COMMUNICATIONS SYSTEMS Interim Scientific Report
J. B. O'Neal, Jr. 29 Jan. 1970 33 p refs
(Contract F44620-69-C-0033; Proj. Themis)
(AD-703724; AFOSR-70-0902TR) Avail: CFSTI CSCL 17/2

The performance of Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM) and Delta Modulation are compared for speech signals. Formulas are presented for the ratios of signal power to quantizing noise power to be expected from operating systems. User reactions to speech quality are related to these signal to noise ratios. For good quality speech encoding systems bit rates of about 25/kilobits/second will be required. At this bit rate, four bit DPCM is the most efficient encoding system to use. The posture taken is conservative--formulas include the effects of equipment misalignment and tandem operation. Most results used herein are not derived but are quoted from other sources. Application to AACOMS and MALLARD are discussed. Also included are brief sections on equipment complexity, dynamic range, the effect of line errors, encryption, the effect of equipment misalignment and tandem operation. Author (TAB)

N70-31576# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE RESULTS OF THE LES-5 AND LES-6 RFI EXPERIMENTS
William W. Ward, Raymond L. Sicotte, K. H. Hurlbut (Aerospace Corp., Los Angeles), and C. J. Zamites, Jr. (Aerospace Corp., Los Angeles) 6 Feb. 1970 56 p refs
(Contract AF 19(628)-5167)
(AD-703738; TN-1970-3; ESD-TR-70-8) Avail: CFSTI CSCL 17/2.1

The RFI environment near synchronous orbital altitude in the band 255-280 MHz was measured by subsynchronous Lincoln Experimental Satellite-5 (LES-5). Similar measurements covering the band 290-315 MHz have been made by station-kept LES-6. The nominal sensitivity of the LES-5 RFI instrument (signal-noise) corresponds to Earth-surface transmitter EIRP of 50 to 100 w (RHCP) near 255 MHz. LES-5 sensitivity is 20 db poorer toward the high end of its band (280 MHz). The nominal sensitivity of the LES-6 RFI instrument corresponds to EIRP of 10 to 25 w (RHCP) across the band 290-315 MHz. The success of the LES-5 and -6 RFI experiments show that it is practical to monitor the level of activity in selected bands of the communication spectrum, throughout wide portions of the Earth, from synchronous orbit. This capability may be useful in the management of portions of the electromagnetic spectrum where frequency allocations are at a premium. Author (TAB)

N70-31582*# Meteorology Research, Inc., Altadena, Calif.
CLOUD COVER EFFECTS ON SIGNAL ATTENUATION AT DSN SITES Final Report
T. B. Smith and C.-W. Chien 24 Apr. 1970 47 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952757)
(NASA-CR-110501; MRI70-FR-922) Avail: CFSTI CSCL 20N

A computational system has been established for the calculation of attenuation statistics at 2.3 G Hz and 8.5 G Hz at each of three DSN sites: Goldstone, Madrid, and Canberra. Data are presented in terms of frequency of occurrence of various attenuation values for each of four seasons and each of four times of day. Results indicate that, statistically, calculated values are lowest at Goldstone and highest at Madrid. Winter months generally show larger attenuation values with minima occurring during summer. Lowest values characteristically occur during the night and highest values in the afternoon although nocturnal low clouds at Canberra yield relatively high attenuation values more frequently than appears in nighttime conditions at the other two sites. Possible errors in the calculation have been examined and found to result mainly from lack of adequate observational data. Cloud characteristics in terms of ice or water and in terms of drop size (mean and concentration) are the two factors primarily responsible for the possible errors. Author

N70-31590# Sperry Rand Corp., Great Neck, N.Y. Management Div.
NATIONAL DATA BUOY DEVELOPMENT PROJECT: LONG RANGE DEVELOPMENT PLAN
Washington Coast Guard Jan. 1970 71 p refs
(Contract DOT-CG-91993-A)
(AD-702797; GB-2520-1032) Avail: CFSTI CSCL 13/10

The report of the Commission on Marine Science, Engineering and Resources responding to the Marine Resources and Engineering Development Act of 1966, recommended six national projects on which initial attention and effort should be centered. One of these six projects is the development of ocean data buoy technology and the deployment of a pilot buoy network. This development plan describes and programs the major tasks which must be completed to advance buoy technology and to implement a pilot buoy network, and ultimately to deploy an operational buoy network if justified. The mission of National Data Buoy Systems is to gather and report meaningful environmental information from the marine areas of the globe on an accurate, real-time, scheduled basis. Only about 20% of the earths surface is now adequately observed for weather information, while the remaining 80%, mostly over the oceans, is inadequately known. This proportion is substantially poorer if oceanographic information is considered, since only the existing thin network of ocean station ships and the occasional research ships now provide oceanographic measurements. Author (TAB)

N70-31592# California Univ., Livermore. Lawrence Radiation Lab.
LRL WEAPONS TEST PROGRAM COMMUNICATION SYSTEMS
R. E. Stefani Jan. 1970 55 p Presented at AFTRCC Meeting, Las Vegas, Nev., 3 - 5 Feb. 1970 Sponsored by AEC
(UCRL-72261; CONF-700202-1) Avail: CFSTI

Two concepts for improving the weapons test facilities at the Nevada Test Site are presented. (1) Provide an RF transmission system that will enable one central controller to perform all the nuclear device orientated functions between it and the device ground zero sites. The new Device Timing and Control (T&C) System will replace the existing hardwire system that operates from several central control points. (2) Provide an RF transmission system for the Nevada Automated Diagnostic (NAD) System. The NAD system concept is to modernize the data acquisition and analysis capabilities presently available at the Nevada Test Site. The RF transmission system will enable one central controller to perform all the diagnostic data oriented functions between it and the acquisition units at the ground zero sites. NSA

N70-31603*# Polhemus Navigation Sciences, Inc., Burlington, Va.
BACK SCATTERING FROM TERRAIN
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 4 - 11 (See N70-31601 16-21)
Avail: CFSTI CSCL 17I

The difference in the radar returns at low grazing angles from a runway and the adjacent terrain determines whether an independent approach and landing monitor radar can of itself locate the runway, or whether enhancement techniques are required. The factors affecting backscatter from terrain are the scattering coefficient, surface roughness, grazing angle, polarization, frequency, and seasonal and meteorological effects. Author

N70-31604*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
ATTENUATION OF RADAR SIGNALS BY WEATHER AND THE RESULTING EFFECTS ON RADAR PERFORMANCE

In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 12-26 (See N70-31601 16-21)
Avail: CFSTI CSCL 17I

The attenuation of radar signals by water vapor and water droplets is considered. The attenuation due to oxygen absorption is not included, although oxygen absorption can cause appreciable attenuation. However, by assuming a Ka band frequency of 35 GHz and a V band frequency of 70 GHz, it is assumed that oxygen absorption will not be a key factor in selecting a desirable operating band for a radar sensor. Author

N70-31605*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
BACKSCATTER FROM RAIN
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 27-29 (See N70-31601 16-21)
Avail: CFSTI CSCL 17I

Theoretical values are derived for the radar cross section of rain. Due to multiple scattering, the measured values are lower than the given theoretical values. Values are plotted for different rainfall rates and are valid for linearly polarized transmission. R.B.

N70-31607*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
SIGNAL LEVEL CALCULATIONS
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 37-61 (See N70-31601 16-21)
Avail: CFSTI CSCL 17I

The calculation of signal levels and signal level ratios which are used to characterize the radar sensor are presented. The calculations include the signal reflected from grassy terrain, receiver noise, the signal reflected from rain, the ratio of terrain signal to receiver noise, the ratio of reflector signal to receiver noise, reflector size, and beacon power. R.B.

N70-31608*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
INTERFERENCE
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 62-69 refs (See N70-31601 16-21)
Avail: CFSTI CSCL 17I

Direct interference arises when the signal received from another aircraft by direct transmission is greater than the desired signal from the ground within the operating range. The amplitude of the desired signal is always greater than 10db above noise or 10db above rain echo depending upon which is the greater. Since the most common cause for the limitation in range is the signal to noise ratio falling below 10db, calculations are made of the conditions under which the interference is more than 10db above the receiver noise level. Author

N70-31612# Mitre Corp., Bedford, Mass.
ADAPTIVE SIGNAL PROCESSING FOR IONOSPHERIC DISTORTION CORRECTION
D. J. Belknap, R. D. Haggarty, and B. D. Perry Mar. 1970 42 p refs
(Contract AF 19(628)-5165)
(AD-704135; MTR-746; ESD-TR-70-30) Avail: CFSTI CSCL 17/2

Ionospheric distortions limit the usable signal bandwidth of HF over-the-horizon paths. By measuring the transfer function of the path and correcting for it in real time, improved bandwidth capability results. To determine the feasibility of such a real-time correction technique, data has been gathered on an HF link. A non-real-time computer simulation of a correction technique has shown that for the bandwidths analyzed, the correction technique is feasible and that the corrections will not deteriorate significantly for several seconds. Author (TAB)

N70-31613# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
UHF RADIO FREQUENCY INTERFERENCE MEASUREMENTS AT SYNCHRONOUS ALTITUDE, NOVEMBER 1965-JANUARY 1969
K. H. Hurlbutt and C. J. Zamites, Jr. 9 Jan. 1970 20 p refs
(Contract F04701-69-C-0066)
(AD-703712; TR-0066(5230-01)-1; SAMSO-TR-70-116) Avail: CFSTI CSCL 17/2

A synchronous satellite-borne RFI monitor experiment that has collected data over an 18-month period is described. Data that have been merged as a function of geographical position of the satellite are presented and discussed. Author (TAB)

N70-31620# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
ANALYSIS AND EVALUATION OF SPEECH PCM AND DIFFERENTIAL PCM SYSTEMS USING VARIOUS LOGARITHMIC AND EXPONENTIAL QUANTIZERS
Stefanos L. Photiades 12 Jan. 1970 77 p refs
(Contract F44620-69-C-0033; Proj. Themis)
(AD-703722; AFOSR-70-0901TR) Avail: CFSTI CSCL 17/2

The report presents a theoretical analysis and computer simulations of differential PCM and PCM systems used for speech signals. The simulations were performed in real time on an Adage AGT-10 hybrid computer using a speech sentence as input. The quantizers used were either logarithmic or exponential. The performance of the systems with varying amounts of companding were compared. The performance metric used in theoretical derivations and in the computer simulations is the signal to quantizing noise power ratio. Three, four, five, and six bit PCM and differential PCM systems were simulated and compared. Logarithmic quantizers with low-mu were found to be superior to exponential quantizers. At any given bit rate differential PCM was superior to PCM. Author (TAB)

N70-31644*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC EFFECTS ON WAVE PROPAGATION AT 10.6 MICRONS
William E. Webb, Kermit H. George, and Peter Marrero 30 Apr. 1970 38 p refs
(NASA-TM-X-64513) Avail: CFSTI CSCL 20N

A CO2 laser communications system using optical heterodyne detection was operated over a 3.2 km path. Both scintillation and heterodyne measurements were made for varying receiver apertures and under varying atmospheric conditions. The results were analyzed to determine the statistical distribution function for the intensity fluctuations, the atmospheric structure constant, and the power spectrum. Signal-to-noise measurements indicate that reliable heterodyne communiations are possible evan under deep scintillation conditions. Author

N70-31668# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURES AND TELEVISION ENGINEERING: SELECTED ARTICLES
A. A. Solntsev et al 5 Jan. 1970 16 p refs Transl. into ENGLISH from Tekhn. Kina i Televideniya (Moscow), v. 13, no. 7 1969 p 63-66
(AD-702954; FTD-MT-24-359-69) Avail: CFSTI CSCL 17/2

Contents: U. S. Board on geographic names transliteration system; A television unit for observing high-contrast objects; Multilayer photoelectric image converters. TAB

N70-31728# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING SELECTED ARTICLES

3 Feb. 1970 33 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 11, no. 6, 1967 p 37–39 and 43–51
(AD-704199; FTD-MT-24-367-69) Avail: CFSTI CSCL 17/2

Contents: Introduction of LI-415 vidicons for television transmission; and Investigation of automatic controls of television receivers. TAB

N70-31775# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIFIED HIGH-FREQUENCY FOR LONG-DISTANCE COMMUNICATION TERMINAL STATIONS EXCERPT
O. I. Astashkina 1 Dec. 1969 15 p ref Transl. into ENGLISH from the publ "Unifitsirovannoye Vysokochastotnoye Dlya Okonechnykh Stantsiy Dalney Svyazi" Moscow, Svyaz, 1966 p 16–21
(AD-702848; FTD-HT-23-547-69) Avail: CFSTI CSCL 17/2.1

The report deals specifically with the types and functions of standard equipment racks (conversion and generator) found at the terminal stations of long-line multichannel multiplexing systems of the kind worked over coaxial-cable or radio-relay circuits. TAB

N70-31785# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
EFFICIENT DIGITAL ENCODING METHODS FOR IMPROVED MILITARY COMMUNICATION SYSTEMS Annual Scientific Progress Report No. 2, 2 Apr. 1969 – 1 Apr. 1970
J. B. O'Neal, Jr. 1 Apr. 1970 109 p refs
(Contract F44620-69-C-0033; Proj. Themis)
(AD-703725; AFOSR-70-0903TR) Avail: CFSTI CSCL 17/2

The research program is designed to accomplish two primary objectives: (1) to obtain a basic understanding of the digital encoding process and to derive an optimum digital encoding algorithm under certain general conditions, and (2) to determine explicitly what kinds of practical digital encoding equipment should be used for the various tasks which require it. In order to accomplish these objectives, five working groups were formed and progress is reported herein in each of these groups -- source encoding theory, speech encoding, video encoding, pattern recognition and computer simulation. Author (TAB)

N70-31816# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING: SELECTED ARTICLES
A. K. Kustarev et al 15 Jan. 1970 43 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (USSR), v. 11, no. 8, Aug. 1967 p 41–47, 51–56
(AD-704290; FTD-MT-24-369-69) Avail: CFSTI CSCL 17/2

Contents: Optimum color system of a color television pickup installation; Aperture-element characteristics of image transmission equipment; Three-dimensional display on a stereotrone; and Bulgarian (PTU) industrial television systems. TAB

N70-31854*# Westinghouse Electric Corp., Baltimore, Md. Electronics Systems Support Div.
WIDEBAND STUDY REPORT FOR ERTS GROUND DISPLAY EQUIPMENT INTERFACE REQUIREMENTS Final Report, Jan. – Apr. 1970
Apr. 1970 74 p refs
(Contract NAS5-11196)
(NASA-CR-110532) Avail: CFSTI CSCL 09B

The sensing of the earth by a satellite sensor several hundred miles above the earth surface can produce wideband data even for modest image resolution. The Earth Resources Technology Satellite (ERTS) multi-spectral sensor (MSS) planned for a 1972 launch has a resolution of about 200 feet and provides data at a 15 megabit per second (Mb/s) rate. Reduction of this resolution to 50 feet increases the data rate to over 200 Mb/s. It is possible that with such required rates, limitations in the spacecraft, the communications system, or the data acquisition system may prevent satisfactory implementation. Since the subject of this study was the data acquisition system, the specific areas considered included high speed logic for data synchronization, wideband data recording and playback, data buffering, computer controlled annotation of this data, intensity correction based upon system calibration, and generation of black and white and color photographic images. Each of these specific areas as reviewed in sufficient detail to determine the performance limitations, if any. High rate data from an ERTS type spacecraft, and adequately handling at the ground stations is investigated. Author

N70-31860*# Louisiana Polytechnic Inst., Ruston. Dept. of Electrical Engineering.
COLOR TELEVISION SYSTEM FOR A MANNED SPACE BASE Progress Report
Y. Lynn Pan Feb. 1970 31 p refs
(Grant NGR-19-003-003)
(NASA-CR-110525) Avail: CFSTI CSCL 17B

This work is concerned with some of the problems of transmission of live color television information from a ground station, via relay satellite, to an earth orbiting space base (and vice versa). This is an introductory study. Author

N70-31870*# Louisiana Polytechnic Inst., Ruston. Dept. of Electrical Engineering.
NON-GAUSSIAN NOISE Progress Report
Kursad Fevzi Tuncer (M.S. Thesis) May 1970 73 p refs
(Grant NGR-19-003-003)
(NASA-CR-110520) Avail: CFSTI CSCL 20N

Non-Gaussian noise is the subject of this study. The probability density functions for quantization noise, continuous wave interference, atmospheric noise, and impulse noise are presented and discussed in detail. Impulse noise is described by the hyperbolic and Pareto distributions and quantization noise is represented by the uniform error distribution. Both the continuous wave interference and atmospheric noise follow Rayleigh and lognormal distributions. Author

N70-31933# Joint Publications Research Service, Washington, D.C.
THEORY AND METHODS OF RESEARCH ON PERCEPTION OF SPEECH SIGNALS
L. A. Christovich et al 29 Apr. 1970 131 p refs Transl. into ENGLISH of the book "Voprosy Teorii i Metodov Issledovaniya Vospriyatiya Rechevykh Signalov" Leningrad, 1969 p 1 - 183
(JPRS-50423) Avail: CFSTI

CONTENTS:

1. PERCEPTION OF SPEECH L. A. Chistovich and V. A. Kozhevnikov p 1 – 101 refs (See N70-31934 16-07)
2. PSYCHOPHYSICAL AND PSYCHOLOGICAL SCALES V. I. Galunov p 102 – 127 refs (See N70-31935 16-07)

N70-31934# Joint Publications Research Service, Washington, D.C.
PERCEPTION OF SPEECH
L. A. Christovich et al *In its* Theory and Methods of Res. on Perception of Speech Signals 29 Apr. 1970 p 1 – 101 refs (See N70-31933 16-07)
Avail: CFSTI

Elementary information about speech formation, the acoustical properties of the speech signal, and the methods of analysis and synthesis is set forth. Author

N70-31935# Joint Publications Research Service, Washington, D.C.
PSYCHOPHYSICAL AND PSYCHOLOGICAL SCALES

V. I. Galunov *In its* Theory and Methods of Res. on Perception of Speech Signals 29 Apr. 1970 p 102-127 refs (See N70-31933 16-07)
Avail: CFSTI

The principles of the theory and practical methods of the construction of psychological and psychophysical scales are examined. The general ideas and practical methods most widely employed for psychological and psychophysical scaling are presented with an indication of theoretical and practical difficulties with scaling encounters. Author

N70-31942# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE ERASING PROCESS DURING OPERATION OF A VIDICON IN SINGLE-LINE PULSE MODE
S. B. Gurevich et al 6 Jan. 1970 23 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), No. 7, 1968 p 61-68
(AD-702951; FTD-MT-24-340-69) Avail: CFSTI CSCL 17/2.1

Considered is a single line pulse mode of vidicon work. Given are the results of experimental investigation of the erasing process in this mode. Pointed out some peculiarities during potential relief erasing. Author (TAB)

N70-31990# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADAR STATIONS FOR DETECTION AND GUIDANCE
G. B. Belotserokovskiy 2 Feb. 1970 107 p refs Transl. into ENGLISH from the book "Radiolokatsionnyye Ustroystva" Moscow, Oborongiz., 1961 p 37-113
(AD-704053; FTD-MT-24-453-69) Avail: CFSTI CSCL 17/9

Described are the general principles, electrical diagrams, and design features of several types of ground and airborne radar sets of various designation. Moreover, the author does restrict himself to a simple description of the selected models of the appratus, but expands the information on the basis of an analysis of the characteristics and parameters of the sets, and a critical evaluation and comparison of various alternate versions of their diagrams and design. As a result, the reader receives a body of knowledge enabling him to study independently any modern radar equipment. Examined in the book are ground stations for detection and guidance, stations for weapon guidance, the properties of airborne radar sets, radio altimeters, and range meters, stations for navigation and blind bombing. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-30620# Illinois Univ., Urbana. Dept. of Computer Science.
DATA DISC CONTROL GRAPHICS 8
R. Hostovsky, H. E. Lopeman, and R. Miller Dec. 1969 40 p
(Contract AT(11-1)-1469)
(COO-1469-152) Avail: CFSTI

Because of the effort to maintain the maximum data transfer-rate of the Data Disc, some problems were encountered in the design of this control. After some amount of adjustments and redesign, the control has an acceptable operation level. The hardware described in this file number will be used for the initial prototype of our multi-console graphics configuration. CRT frames will be made on the PDP/8 and stored on the Disc for use as refresh for one or more graphic consoles. Author

N70-30624# Argonne National Lab., Ill.
C:WRITE, A REENTRANT ROUTINE TO CONVERT HEXADECIMAL NUMBERS TO EBCDIC DECIMAL
Conrad E. Thalmayer Nov. 1969 37 p
(Contract W-31-109-eng-38)
(ANL-7634) Avail: CFSTI

A reentrant, general-purpose routine is described for the Sigma 5 or Sigma 7 computer with floating-point option. C:WRITE converts hexadecimal numbers of the forms used in the computer into EBCDIC decimal numbers of desired length in I, E, or F format. The need for the routine is explained, its capabilities are described, all the information necessary for using it is presented and its structure is outlined. The flow charts and listing are included. Author

N70-30626# Sandia Corp., Livermore, Calif.
LINEAR SYSTEM POLE-ZERO LOCI PLOTS
R. E. Humphrey Mar. 1970 30 p refs
(Contract AT(29-1)-789)
(SCL-DR-70-15) Avail: CFSTI

The zero-state response of a linear, invariant system is characterized by the system transfer function. When the transfer function can be expressed as a rational function, the zero state stability of the system is determined by the location of the poles of the transfer function, and zero-state response is determined to within a multiplicative constant by the location of the poles and the zeros of the transfer function. A practical problem often encountered in the design of linear systems is that of determining the loci of the poles and zeros of the transfer function of a closed loop system as some one parameter is varied. A computer program is described which accomplishes this task. Author

N70-30627# Sandia Corp., Livermore, Calif.
REFERENCE MANUAL FOR 6612 CONSOLE OPERATIONS WITH MIMIC
R. A. McHugh Feb. 1970 32 p refs
(Contract AT(29-1)-789)
(SCL-DR-70-13) Avail: CFSTI

The 6612 console for the 6600 system operator provides for two simultaneous video displays composed of characters (three selectable sizes) and points (512 × 512 grid). A second such console was implemented with software to support source program and data manipulation, execution control over a job, and rudimentary graphic communication with an application program. A block-oriented simulation processor, MIMIC, was extended and embellished to provide for interaction with the model. Displays and cross-plots of selected variables may be observed as the time history of the system evolves. Constants, parameters, initial conditions, etc. may be changed at will from the keyboard. The system provides the full range of 6600 system capabilities from the console; hence, it is intended for use by or with the aid of a sophisticated 6600 programmer. Author

N70-30630# Iowa State Univ. of Science and Technology, Ames.
AN IMPLEMENTATION OF A PL/I SYSTEMS PROGRAM WHICH DEMONSTRATES THE FEASIBILITY OF SYSTEMS PROGRAMMING IN A HIGH-LEVEL LANGUAGE
G. E. Hedrick Jan. 1970 45 p
(Contract W-7405-eng-82)
(IS-2244) Avail: CFSTI

A method for writing systems programs in high level (PL/I) language instead of the more cumbersome assembly language is presented. Such programs are loader programs which permit one of the standard job steps to be circumvented, possibly resulting in a savings of computer time. Author

N70-30649# Illinois Univ., Urbana. Dept. of Computer Science.
A HIGH SPEED ANALOG DIVIDER FOR THE ILLIAC 3 SCAN SYSTEM

Sergio Franco 3 Oct. 1969 15 p refs
(Contract AT(11-1)-1018)
(COO-1018-1191) Avail: CFSTI

An analog divider is described which forms the ratio for the antilogarithm of the difference of the logarithms. The multiply circuit is a high speed analog multiplier, based on the transistor variable-transconductance principle. The d.c. accuracy of the analog divider prototype is exhibited and the dynamic behavior of the same is shown. It is shown that the time required for the output to settle within 3% of its value is better than one microsecond, and is relatively independent of the magnitude of the denominator. The lead-lag compensation was used for the sake of speed. J.M.C.

N70-30693# Illinois Univ., Urbana. Dept. of Computer Science.
CIRCUIT RESEARCH PROGRAM, HARDWARE SYSTEMS RESEARCH, COMPUTER SYSTEMS RESEARCH, ILLINOIS PATTERN RECOGNITION COMPUTER: ILLIAC 3, AND ILLIAC 4 Quarterly Technical Progress Report, Jul. – Sep. 1969
Sep. 1969 232 p refs
(COO-1469-148; COO-1018-1193) Avail: CFSTI

Research progress is reported in the following areas: (1) In the circuit research program, attention was focussed on LASCOT (Large Screen Color Television) and COLORMATRIX (a liquid crystal color matrix display). Deflection circuit design and the detection and modulation schemes are discussed along with descriptions of the methods developed for measuring and controlling the thermal properties of transistors in the COLORMATRIX project. (2) Hardware systems research involved circuit changes to the erase gun assembly of OLFT (On-Line Fourier Transform System), designed to ensure more reliable and uniform operation. In addition, further modifications were made to ORBIT to allow more realistic representation of horizontal lines, and a scheme for properly synchronizing the receiver was initiated. (3) Progress in computer systems research resulted in the updating of ODESSY, with the matrix inversion program for sparse matrices being rewritten and debugged. (4) A design/development program was undertaken for the Illinois Pattern Recognition Computer with the ILLIAC 3 and ILLIAC 4 systems. Numerous hardware developments and software modifications are described. D.L.G.

N70-30695*# Stanford Univ., Calif. Electronics Labs.
A MODEL FOR PARALLEL COMPUTER SYSTEMS
T. H. Bredt and E. J. Mc Cluskey Apr. 1970 63 p refs
Sponsored in part by AF and Army
(Grant NGR-05-020-337; Contract N00014-67-A-0112-0044)
(NASA-CR-110465; STAN-CS-70-160; SEL-70-014; TR-5) Avail: CFSTI CSCL 09B

A flow table model is defined for parallel computer systems. In this model, fundamental-mode flow tables are used to describe the operation of system components, which may be programs or circuits. Components communicate by changing the values on interconnecting lines which carry binary level signals. It is assumed that there is no bound on the time for value changes to propagate over the interconnecting lines. Given this delay assumption, it is necessary to specify a mode of operation for system components such that input changes which arrive while a component is unstable do not affect the operation of the component. Such a mode of operation is specified. Using the flow table model, a new control algorithm for the two-process mutual exclusion problem is designed. This algorithm does not depend on the exclusive execution of any primitive operations used in its implementation. A circuit implementation of the control algorithm is described. Author

N70-30916*# Maryland Univ., College Park. Computer Sciences Center.
A METHODOLOGY FOR UNIFIED HARDWARE-SOFTWARE DESIGN
Yaohan Chu, Oliver R. Pardo, and Jeffrey Yeh Jan. 1970 92 p refs
(Grants NGR-21-002-206; NGL-21-002-008)
(NASA-CR-110445; TR-70-107) Avail: CFSTI CSCL 09B

A methodology for unifying the hardware and software design of a digital computer by means of the Computer Design Language (or CDL) is given. The methodology is presented in three examples: (a) finding the largest number among n given numbers, (b) buffer allocation in an input – output control system, and (c) translation of relocatable code to executable code. The algorithms in these examples are all obtained from computer programs. Important steps of the methodology are shown in great details. These are: description of the configuration by the CDL declaration statements, translation of the flow chart into the sequence chart, representation of timing and control signals, implementation by microprogram control, description of sequential operations by the CDL execution statements, production of microprogram, and simulation of the design on the CDL Simulator. Author

N70-30937# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
USER'S MANUAL: GENERALIZED INFORMATION STORAGE AND RETRIEVAL QUERY SYSTEM
Richard V. Dardano Jan. 1970 34 p
(AD-700921) Avail: CFSTI CSCL 9/2

The manual describes the Generalized Information Retrieval Query System and provides procedures and instructions for creating the data base, loading a time-sharing computer, and retrieving specified information via a remote terminal. Using the system, an analyst may load into computer storage, in a pre-defined format, information or data and then selectively retrieve and examine individual records or groups of records containing like characteristics. The system is designed primarily for the solution of individual problems over relatively short time periods. TAB

N70-30991*# National Aeronautics and Space Administration, Washington, D.C.
LEGAL PROTECTION FOR COMPUTER PROGRAMS
John R. Manning May 1970 59 p refs Presented at a US Civil Serv. Comm. Seminar on ADP and the Law, 6 May 1970
(NASA-TM-X-62964) Avail: CFSTI CSCL 09B

The legal aspects of protecting computer programs are discussed by considering the approaches taken by the general practicing attorney. The possibilities of trademark registration, copyright registration, trade secret, patent, and by contract are analyzed. The ruling by the patent office is cited that mental processes revolving around logical processes and mathematical equations cannot be patented. The role of NASA in government sponsored programs is also discussed. F.O.S.

N70-30996# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIENCE IN USING THE DNIEPER COMPUTER AND PROSPECTS FOR THE DEVELOPMENT OF CONTROL COMPUTERS FOR CONTINUOUS PROCESSES
B. N. Malinovskii 15 Dec. 1969 9 p Transl. into ENGLISH from the Russian
(AD-702981; FTD-MT-24-254-69) Avail: CFSTI CSCL 9/2

The paper gives a short historical account of the use of the first Dnieper computers and outlines possible applications of futurs improved models. TAB

N70-31042# Iowa State Univ. of Science and Technology, Ames.
AUTOMATIC FILE INTEGRITY IN COMPUTER SYSTEMS
John R. Jordan Jan. 1970 8 p refs
(Contract W-7405-eng-82)
(IS-2242) Avail: CFSTI

A process is described which automatically regulates the systematic rotation of magnetic tapes used in computer systems. This process ensures that correct generations of data are associated with the proper volumes and automatically provides for back-ups in case of errors. Author

N70-31068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ORGANIZING AN INFORMATION SYSTEM BASED ON THE DNIEPR COMPUTER
A. I. Nikitin et al 5 Jan. 1970 9 p Transl. into ENGLISH from the Russian
(AD-702967; FTD-MT-24-410-69) Avail: CFSTI CSCL 9/2

The requirements of a computer to be used in an information system are the following: it must permit parallel exchange of information over many channels; it must permit the use of different information codes, the translators of which must be compact and must provide programs guaranteeing rapid operation and effective memory; it must limit the maximum time devoted to a problem in conformity with the requirements of an efficient system. This article describes one possible variant for organizing exchanges in an operational system developed as an information-control system. The basis for this system is the Dnieper electronic digital computer, a fast-acting device which can handle 20,000 additions per second, has a capacity of 32,000 words of 32 bits each, can store up to 8,000,000 words on magnetic tape, and contains a letter-digit printing device, tens of teletypes, and a keyboard operating panel. A description of the information exchange in such a system is given. Author (TAB)

N70-31152# Bettis Atomic Power Lab., Pittsburgh, Pa.
FORTRAN UNIT RECORD SIMULATION TECHNIQUE (FURST)
P. A. Brodict and L. F. Guzik Feb. 1970 115 p
(Contract AT(11-1)-GEN-14)
(WAPD-TM-747) Avail: CFSTI

This report contains a combination of training and reference material intended for personnel who want to utilize the facilities of a digital computer for administrative data processing applications, but who lack computer programming training. Prior knowledge of computers and programming terminology is not required of the user, but he should have an understanding of the concepts and terms of unit record data processing such as collating, printing, reproducing, sorting, calculating, etc. This report may also be valuable to the sophisticated programmer since it describes a system which is easy to learn, to use, to debug, and to change, yet sufficiently powerful to perform almost every application common to data processing. Author

N70-31201# California Univ., Los Angeles. School of Engineering and Applied Science.
LOW LEVEL SELF-MEASUREMENT IN COMPUTERS
Robert A. Koster Oct. 1969 167 p refs
(Contract AT(11-1)-Gen-10)
(UCLA-10-P-14-84; Rept-69-57) Avail: CFSTI

Tools that have been developed for low level self-measurement, requiring no special hardware, are described. One tool is an efficient self-simulator that closely duplicates the operation of the machine it is running on. It can be probed at the sub-instruction level by a data collection routine to determine detailed characteristics of the programs running on it. Simulators for the IBM System/360 and the SDS Sigma-7 computers and a set of data collection routines for these simulators are described. The other tools are implementations of algorithms for making high precision measurements of the time duration of events or activities in a computer. One of them measures the time interval of an activity in an operating program to about 2 microseconds accuracy using only an 8 MHz clock. The other measures the execution time of an isolated routine when the measurement must take place in a multiprocessing, multiprogrammed environment. Author

N70-31230# Sandia Corp., Albuquerque, N. Mex.
TWO COMPUTERIZED METHODS FOR PLOTTING FUNCTIONS OF TWO INDEPENDENT VARIABLES
W. D. Sundberg Feb. 1970 37 p ref
(SC-DR-70-112) Avail: CFSTI

One method provides a pictorial plot of the three-dimensional surface, and the other provides a plot of isograms on the plane of the independent variables. FORTRAN subroutines, which implement both methods, have been used on the CDC-6600 and the Univac 1108 computers, and instructions for the use of the subroutines, as well as listings of the subroutines, are provided. A description of how each method works is given. Author

N70-31235# Iowa State Univ. for Science and Technology, Ames.
KERTRAN COMPILING SYSTEM
C. L. Cate, W. J. Higby, and R. L. Wagstaff Dec. 1969 70 p refs
(Contract W-7405-eng-82)
(IS-2230) Avail: CFSTI

An analysis of the KERTRAN language translator that operates in conjunction with the on-line measuring system for bubble chamber film data at Iowa State University is presented. Included is a discussion of programming considerations in designing a translator and of the methods by which these problems were resolved in the KERTRAN compiler. A detailed discussion of the major elements of the compiler, namely the instruction types, the name table, and the instruction table, is given; and an analysis of future improvements is made. Short descriptions of each of the KERTRAN routines, program listings, and flowcharts of the major routines are given. Author (NSA)

N70-31276# Sandia Corp., Albuquerque.
ANNOUNCEMENT OF THE AVAILABILITY OF SEVER: COMPUTER ROUTINE FOR SYMMETRIC MATRIX EIGENVECTORS WITH ERROR BOUNDS
W. R. Gavin Apr. 1970 4 p
(SC-M-70-232) Avail: CFSTI

The reasons the computer routine was written, applicable programming languages and computers, and considerations regarding use are described. Author

N70-31299# Illinois Univ., Urbana. Dept. of Computer Science.
GRAPHICS 8: GRAPHICS HARDWARE, 1469 GEAR
C. E. Carter, R. Hostovsky, H. Levin, H. Lopeman, and R. Miller Dec. 1969 82 p refs
(Contract AT(11-1)-1469)
(COO-1469-151; Rept-371) Avail: CFSTI

This report was written to serve as a reference manual for the 1469 group in their everyday graphics work, and as an applications manual for use by those University people who make use of the graphics facility. The report is divided into the basic system, operating additions, and proposed additions. The basic system made up of a 16K-PDP-8 with interval timer, an ASR33 Teletype, 2 ea Dectapes, and a PDB-338 was installed and checked-out in June of 1967. The operating additions have been made over the past two years. The proposed additions are being worked-on for purposes of making the total facility better for user applications. Author

N70-31300# Stanford Univ., Calif. Dept. of Computer Science.
SPECTRUM OF INCORRECTLY DECODED BURSTS FOR CYCLIC BURST ERROR CODES
Harold S. Stone Jan. 1970 24 p refs
(Contract AT(04-3)-326)
(SU-CS-70-154) Avail: CFSTI

The enumeration of the incorrectly decoded bursts for cyclic burst error codes is reported. The enumeration yields closed formulae for long bursts, whereas an efficient algorithm for the enumeration is given for the short bursts. The enumeration is carried

out for two different decoding rules. Under the first rules, the cyclic codes is a full length codes, and split decodable patterns are decoded by the decoder in spite of the fact that a split decodable pattern can be a burst that exceeds the decoding capability of the decoder. The second decoding rule assumes that split decodable bursts are not decoded. The analysis for the second rule includes the class of shortened cyclic codes. Author

N70-31344# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Computer Support Div.
BRLESC 1/2 FORTRAN
Lloyd W. Campbell and Glenn A. Beck Mar. 1970 162 p refs
(AD-704343; ARDC-TR-5) Avail: CFSTI CSCL 9/2

The report describes the FORTRAN language in general and includes specific details about its implementation on the BRLESC I and BRLESC II computers at the Aberdeen Research and Development Center. Author (TAB)

N70-31345# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
A THREE-DIMENSIONAL PLOTTING PACKAGE FOR THE IBM/7090
Alfred Hume 10 Apr. 1970 43 p
(Contract W-7405-eng-26)
(CTC-31) Avail: CFSTI

The characteristics of a three dimensional plotting package for the IBM/7090 computer are described. It is written for the 7090 in MAP and takes the form of four FORTRAN-callable subroutines. The design is constructed by specifying pen moves in three dimensions. Eighty-eight operators are implemented which provides for moving the pen, changing the frame of reference, and various control functions. Pen moves are specified in Cartesian or polar coordinates and with respect to either an origin or current pen position. Operators are provided for generating circular arcs. Author

N70-31415# Oak Ridge National Lab., Tenn.
INTERFACE FOR THE HEWLETT PACKARD 5400 MULTICHANNEL ANALYZER TO THE LINC-8 COMPUTER
J. E. Francis and O. C. Yonts 9 Mar. 1970 7 p Sponsored by AEC
(ORNL-TM-2920) Avail: CFSTI

The Hewlett Packard 5400 analyzer has been connected to the LINC-8 computer using the serial, digital, output option of the HP analyzer and the program interrupt input facility of the LINC-8 computer. The format for the transfer is an address plus 10 channels of data line including leading zero suppression. Each line ends with carriage return, line feed. Each channel of data is separated by a space. The code used is ASC 2 with parity. In addition, there is a start of message character, and end of message character, and a trailer message of 10 zero characters. Author

N70-31445# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF PERMUTATION CYCLES TO STORAGE MANAGEMENT
Joan R. Hundhausen 9 Jan. 1970 4 p ref
(Contract W-7405-eng-36)
(LA-4359) Avail: CFSTI

A scheme is presented for manipulation of computer storage. It is a direct application of a permutation of N elements, and is particularly applicable when a computer has a hardware capacity for moving relatively large blocks of storage quickly and efficiently. Two noteworthy features are: each element is moved only once; only two elements of auxiliary storage are required. Author

N70-31521# Stanford Linear Accelerator Center, Calif.
AN APL MACHINE
Philip S. Abrams Feb. 1970 204 p refs
(Contract AT(04-3)-515)
(SLAC-114) Avail: CFSTI

Proposed is a design for a machine structure which is appropriate for APL and which evaluates programs in this language efficiently. The approach taken is to study the semantics of APL operators and data structures rigorously and analytically. By applying the standard form transformation to storage access functions for arrays, select expressions in the machine can be evaluated without having to manipulate array values; this process is called beating. Drag-along is a second fundamental process which defers operations on array expressions, making possible simplifications of entire expressions through beating and also leading to more efficient evaluations of array expressions continuing several operations. The APL machine consists of two separate sub-machines sharing the same memory and registers. The D-machine applies beating and drag-along to defer simplified programs which the E-machine then evaluates. The major machine registers are stacks, and programs are organized into logical segments. The performance of the entire APL machine is evaluated analytically by comparing it to a hypothetical naive machine based upon presently-available implementations for the language. Author (NSA)

N70-31587# System Development Corp., Santa Monica, Calif.
ALGORITHMIC LANGUAGES Final Report, 1 Jul. 1966 - 30 Jun. 1969
Seymour Ginsburg 1 Jul. 1969 12 p refs
(Contract F19628-67-C-0008)
(AD-702812; TM-4348/000/00; AFCRL-69-0326) Avail: CFSTI CSCL 9/2

The overall goal of the study was the development of an adequate theory for programming (algorithmic) languages. In order to achieve this goal there were two specific objectives: (1) The development of suitable mathematical models of currently used programming languages such as ALGOL, COBOL, and JOVIAL (2) The use of mathematical models to answer questions of interest about these languages. The document is a final report of the study and contains a listing of technical papers written. TAB

N70-31591# Oak Ridge National Lab., Tenn.
OAK RIDGE DATA EVALUATION AND ANALYSIS LANGUAGE
M. Feliciano, C. W. Nestor, Jr., N. B. Gove, and T. D. Calton Mar. 1970 126 p
(Contract W-7405-eng-26)
(ORNL-4506) Avail: CFSTI

A manual for ORDEAL (Oak Ridge Data Evaluation and Analysis Language), a general purpose system designed to facilitate routine data analysis is presented. Standard operations in ORDEAL include curve-fitting, plotting, interpolating, editing, and processing of data sets. ORDEAL has been kept as simple as possible; no programming experience is required. ORDEAL can be linked with FORTRAN. Author

N70-31600# National Bureau of Standards, Washington, D.C. Center for Computer Sciences and Technology.
RESEARCH AND DEVELOPMENT IN THE COMPUTER AND INFORMATION SCIENCES. VOLUME 3: OVERALL SYSTEM DESIGN CONSIDERATIONS—A SELECTIVE LITERATURE REVIEW
Mary Elizabeth Stevens Jun. 1970 148 p refs
(NBS-Monograph-113-Vol-3) Avail: SOD $1.25

A selective literature review involving overall system design considerations in the planning of information processing systems and networks. Specific topics include but are not limited to: requirements and resources analysis, problems of system networking, input/output and remote terminal design, character sets, programming problems and languages, processor design considerations, advanced hardware developments, debugging and on-line diagnosis or instrumentation, and problems of simulation. Author

N70-31628# Naval Weapons Lab., Dahlgreen, Va.
FORTRAN 4 PROGRAMMING FOR CARTOGRAPHY AND TYPOGRAPHY
A. V. Hershey Sep. 1969 105 p
(AD-703220; NWL-TR-2339) Avail: CFSTI CSCL 5/2

Documentation is provided for a new system of cartography and typography. Input to the system is on IBM punched cards. Typographic input is in the FORTRAN IV character set. A card of textual data is followed by any number of cards of functional data. Mnemonic control codes are provided for the functional data. Samples of output from the new system have been prepared on a mechanical plotter and on a cathode ray printer. Author (TAB)

N70-31633*# National Aerospace Education Council, Washington, D.C.
AEROSPACE BIBLIOGRAPHY, FIFTH EDITION
Jan. 1970 102 p refs Prepared for NASA
(NASA-EP-48) Avail: SOD $1.00; CFSTI CSCL 09D

An updated annotated bibliography of references, periodicals, and educational materials related to space flight is presented. Author

N70-31635*# Rice Univ., Houston, Tex.
DEPT. OF MECHANICAL AND AEROSPACE ENGINEERING AND MATERIALS SCIENCE. GRADIENT METHODS IN CONTROL THEORY. PART 5: SEQUENTIAL GRADIENT-RESTORATION ALGORITHM, ADDITIONAL NUMERICAL EXAMPLES
J. N. Damoulakis 1970 32 p refs
(Grant NGR-44-006-089)
(NASA-CR-110523; AAR-73) Avail: CFSTI CSCL 12A

In order to reach a more complete understanding of the properties of the sequential gradient-restoration algorithm, several modifications and extensions are studied. These modifications and extensions are concerned with (i) the scheme for updating the state, the control, and the parameter, (ii) the possibility of employing an incomplete restoration phase at the end of each gradient phase, and (iii) the search technique for the gradient stepsize. Several numerical examples are given. Author

N70-31639# North Carolina Univ., Chapel Hill. Dept. of Computer and Information Science.
AN INVESTIGATION OF A SYSTEM FOR DISPLAYING COMPUTER OUTPUTS TO THE KINESTHETIC SENSE
Progress Report, 1969 - 1970
Frederick P. Brooks, Jr. 1970 7 p
(Contract AT(40-1)-3817)
(ORO-3817-2) Avail: CFSTI

The GROPE 1 system with two degrees of freedom was completed. Computer descriptions of a large set of force fields were programmed, and initial testing of the system and of individual displays were performed. Force display effectiveness measured by a controlled experiment is discussed. The effectiveness and limitations of a A-D, D-A system in a time shared environment were also studied, along with a system design on the full scale 3-D system. J.A.M.

N70-31701# Akademiya Nauk URSR, Kiev.
APPLICATION OF COMPUTERS FOR ANALYSIS OF THE STABILITY AND SHORT-CIRCUIT CURRENTS IN ELECTRIC POWER SYSTEMS
I. G. Bobrysheva, ed. 1968 179 p refs In RUSSIAN
Avail: CFSTI

Methods are considered for modeling and developing digital programs to calculate stability and short-circuiting currents in electric power systems. For individual titles, see N70-31702 through N7031722.

N70-31702# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
METHODS OF COMPARING AND APPROVING PROGRAMS FOR THE COMPUTERIZED SOLUTION OF COMPLEX TASKS IN ANALYZING THE CONDITIONS OF ELECTRICAL POWER SYSTEMS
L. V. Tsukernik *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 8-15 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

An attempt is made to establish the criteria for setting up standard programs to perform the required analyses. Such programs are designed to eliminate errors and duplications of effort. The methods used are based on the development of a library which contains typical control problems. The library uses special reference programs where possible. Transl. by H.W.

N70-31703 Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
USING THE URAL-2 COMPUTER TO PERFORM EXPERMENTAL CALCULATIONS OF THE DYNAMIC STABILITY OF ELECTRIC POWER SYSTEMS
V. N. Avramenko and L. V. Tsukernik *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 16-22 In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Possibilities were explored for using computer program IV-2 to determine the dynamic stability of complex electric power systems. The program was evaluated in relation to the volume of problems solved, the speed of computation, the design of the automatic excitation control and the dynamic characteristics of the load. Methods of automatically preventing breakdowns and the form for presenting input information were also studied. Transl. by H.W.

N70-31704# Akademiya Nauk URSR, Kiev.
DIGITAL COMPUTER CALCULATIONS OF THE DYNAMIC STABILITY OF A 500 KILOVOLT NETWORK USING A PROGRAM OF THE INSTITUTE OF ELECTRODYNAMICS OF THE ACADEMY OF SCIENCES, UKRAINIAN SSR
S. A. Sovalov, E. V. Turskiy, and N. N. Shelukhin *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 23-29 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

The programs permit computation of transient electromechanical process in a complex electric power system. Studies were conducted in two stages. In the first stage calculations were made for assimilation and preprocessing of the program, and for detecting and eliminating ambiguities. The calculations were conducted for the case of a three-phase short circuit at various points in the 500 circuit. Comparative calculations were then made for dynamic stability. In the second stage a study was conducted for the dynamic stability of the 500 network in connection with closing the 500 Moscow ring. Transl. by H.W.

N70-31705# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
USING A DIGITAL COMPUTER TO ANALYZE THE STATIC OUTPUT LIMIT OF A COMPLEX ELECTRIC POWER SYSTEM
K. V. Korobchuk *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 30-45 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

A general algorithm and subprograms are described for calculating the static output limit of a complex power system. The results of experimental calculations using two variants of the complex program are presented. Transl. by H.W

N70-31706# Adakemiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
ANALYZING THE EFFECT OF DEVIATIONS OF CALCULATING PARAMETERS FROM REAL VALUES IN DIGITAL COMPUTER CALCULATIONS OF STEADY MODES IN ELECTRIC POWER SYSTEMS
V. G. Derzskiy and A. V. Levchenko *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 46-61 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

A method is presented for quantitative analysis of the effect of input inaccuracy on digital computer calculations of current distribution in an electric power system. Several variants of the calculating problem are compared. Transl. by R.B.

N70-31707# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
USING DIGITAL COMPUTERS TO INVESTIGATE SENSITIVITY TO VARIATION OF INPUT DATA FOR DIFFERENT METHODS OF ANALYZING THE STABILITY OF ELECTRIC POWER SYSTEMS
V. G. Derzskiy and A. V. Levchenko *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 62-74 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Two methods are considered for investigating the sensitivity to random variations of input data with respect to the static stability of frequency-phased and D-division of statistical analysis by computer calculations. Mathematical models are constructed for comparing the random statistical distribution of input parameters. The experiments show that the method of D-division is more sensitive than that of frequency-phased division. Transl. by R.B.

N70-31708# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
A PROGRAM FOR CALCULATING THE STEADY ELECTRICAL MODE OF ELECTRIC POWER SYSTEMS BY CONSIDERING THE STATIC CHARACTERISTICS OF LOADS
N. A. Kachanov and V. V. Umedyan *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 75-85 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

The program is designed for calculating the pre- and post-emergency steady electrical modes of a complex electric power system. It permits calculations with and without reducing the resistance elements of the network to a single voltage level by considering the real coefficients of transformer transformation and the static characteristics of the loads. Calculations are accomplished by the iterative method for solving equations of nodal voltages using the rate of coincidence of the iterative process. Transl. by R.B.

N70-31709# Akademiya Nauk URSR, Kiev. Ist. Elektrodinamiki.
INPUT FORMULAS AND THEIR TRANSFORMS FOR DIGITAL PROGRAMMING CALCULATIONS OF EMERGENCY AND POSTEMERGENCY ELECTRICAL MODES
V. V. Umedyan *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 86-93 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Algorithms are derived for performing the calculations by using the node method and iterative solution. The time required to solve different types of problems is dependent on the composition of the algorithm of solution. Transl. by R.B.

N70-31710# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
DIGITAL COMPUTER CALCULATION OF SINGLE-PHASE SHORT-CIRCUITING CURRENTS IN 500 KILOVOLT NETWORKS USING THE CONTOUR METHOD WITH AUTOMATIC CYCLING OF VARIANTS
Ye. V. Khrushchova *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 94-102 refs in RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

The described method employs the principle of superposition, in which the short-circuiting mode of the preemergency state of the network is made up of the short-circuiting mode of real voltages in the nodes up to the moment of short-circuitning and of the preemergency mode. It is assumed that dummy branches are connected in the network nodes, they are joined to a common neutral, and have zero resistances. Transl. by R.B.

N70-31711# Akademiya Nauk URSR, Kiev. Inst. of Elektrodinamiki.
CONSIDERING MUTUAL INDUCTANCE IN DIGITAL CALCULATIONS OF SINGLE-PHASE SHORT CIRCUITS IN 110 TO 220 KILOVOLT NETWORKS AND THEIR AUTOMATION BY MODIFICATIONS IN THE NETWORK CIRCUIT
Ye. V. Khrushchova *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 103-108 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

A method is described which permits calculation of mutual inductance corrections by constructing a matrix of node resistances for digital calculation of short-circuiting currents. The calculations are made by using matrices of contour resistances. The modifications are accomplished by introducing changes into the resisitance matrix of a group of inductively connected branches and corrections to the matrix elements of node resistances are calculated by corresponding formulas. Transl. by R.B.

N70-31712# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
AUTOMATED CALCULATIONS OF SHORT CIRCUIT CURRENT CHARACTERISTICS USING VOLTAGE NODE MATRIX METHODS
V. A. Krylov *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 109-115 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

The processing of data on a short circuit in a node incorporated in a circuit containing a supplementary current source is described. Formulas for energy values are derived using the method of symmetric components. Consideration is given to the automatic calculation of circuit operating conditions on the basis of computations of the fundamental mode. Transl. by E.C.

N70-31713# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
COMPUTERIZED CALCULATIONS OF EMERGENCY SHORT-PHASE STATE USING VOLTAGE NODE MATRIX METHODS
V. A. Krylov *In its* Appl. of Computers for Analysis of the Stability and Short Circuit Currents in Elec. Power Systems 1968 p 116-122 In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

A short-phase operating condition with and without short circuiting is investigated. Phase discontinuity of the branch circuit and a short circuit in a current node are examined by introducing additional active elements into the network (voltage and current sources). Formulas for emergency values are derived using the method of symmetric components. Transl. by E.C.

N70-31714# Akademiya Nauk URSR, Kiev.
CALCULATIONS ON SHORT CIRCUITING IN THE SIBERIAN INTEGRATED POWER NETWORK USING THE URAL-2 COMPUTER SYSTEM
E. V. Kamenskikh and V. S. Shevchenko *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents Systems

1968 p 123–129 In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Characteristics of five computer programs for analysis of single and triple-phase short circuit currents in the Siberian integrated power network are reviewed. Test runs were carried out for each of the programs allowing for specific calculations of short circuiting within transistor and individual power supply circuits. Transl. by E.C.

N70-31715# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
SHORT CIRCUIT CURRENT CALCULATIONS USING URAL-2 COMPUTER
V. A. Legkiy *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 130–133 In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Programming techniques used in analyzing short circuit currents in power supply circuits are briefly discussed. Matrix methods are used with most of the programs. A voltage node integration method is also used. This method requires more machine time but permits evaluation of larger-scale circuits. Transl. by E.C.

N70-31716# Kiev Polytechnic (USSR).
COMPUTERIZED INVESTIGATION OF GROUP RUNDOWN OF ASYNCHRONOUS MOTORS
N. V. Kosterev *In* Akad. Nauk URSR Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 134–139 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

The electromechanical transient process of group rundown occurring immediately after an energy loss was investigated by mathematically modeling two asynchronous motors. A model was derived using complete Park-Gorev equations. Results show that, when defining the slipping near the close of the power supply interval, attention should be given to the energy cross flow effect between motors, which is mainly dependent on the opposing torque characteristics, inertial constants, and the duty factor. Transl. by E.C.

N70-31717# Akademiya Nauk URSR, Kiev.
SIMPLIFIED CALCULATION OF VOLTAGE RECOVERY VALUES IN SELF-STARTING SPECIAL APPLICATION MOTORS WITH 200 Mw CIRCUIT
V. N. Bazhenov and A. A. Kozma *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 140–142 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Experimental data are given on the resistance change of asynchronous electric motor mechanisms during starting and self-starting. The data are used to derive a simplified formula for voltage recovery in 200 megawatt sections under self-starting conditions. Transl. by E.C.

N70-31718# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
SYSTEM MODELING FOR AUTOMATIC SPEED CONTROL OF A DIESEL-ELECTRIC UNIT
G. L. Baranov and E. G. Zaslavskiy *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 143–150 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

A mathematical model and block diagram are presented for an automatic speed control system for a high power diesel generator. Results are discussed for calculations of transient processes during loading. Transl. by E.C.

N70-31722# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
COMPUTER PROGRAMMING AND HARMONIC ANALYSIS OF FUNCTIONS
Ya. G. Martynenko *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 175–180 In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Harmonic analysis with the aid of the Ural-2 digital computer is briefly discussed. Program input data, a flow chart, and results of calculations on a sample problem are included. Transl. by E.C.

N70-31739# Air Force Systems Command, Wright-Patterson AFB, Ohio.
ONE L-OPTIMAL ALGORITHM FOR INSTRUCTING LEARNING SYSTEMS
A. Kh. Gelig 4 Mar. 1970 12 p refs Transl. into ENGLISH from Vychislitelnaya Tekhn. i Vopr. Kibernetiki (Leningrad), v. 7, no. 5, 1968 p 74–79
(AD-704006; FTD-HT-23-135-70) Avail: CFSTI CSCL 9/2

During the training of recognition systems based on minimum mean square error it is necessary to solve a system of linear algebraic equations which can turn out to be degenerate or poorly stipulated. An algorithm for the approximate solution of such systems is proposed below and an evaluation of disparity is given. Author (TAB)

N70-31749# Iowa Univ., Iowa City. Dept. of Mathematics.
HIGH-RATE BURST-ERROR-CORRECTING RECURRENT CODES
Charles W. Hoffner, II and John P. R Mar. 1970 28 p refs
(Contract N00014-68-A-0500; Proj. Themis)
(AD-703246; THEMIS-UI-TR-21) Avail: CFSTI CSCL 9/4

A bound, construction, and encoding-decoding procedure are presented for high-rate burst-error-correcting recurrent codes. The codes presented are closely related to well-known high-rate burst-error-correcting block codes. Author (TAB)

N70-31788# National Biomedical Research Foundation, Silver Spring, Md.
METHODOLOGY FOR ORGANIZING AND PROCESSING QUALITATIVE RELATIONSHIPS IN OPERATIONS RESEARCH Final Report
Robert S. Ledley, Marilyn Belson, Louis S. Rotolo, James B. Wilson, Richard Bartelmehs et al Feb. 1970 123 p refs
(Contract Nonr-4496(00))
(AD-704171; NBR-6806/4496) Avail: CFSTI CSCL 12/2

The purpose of the study was to develop a methodology for precisely handling qualitative information, which includes relations. Qualitative information usually involves relations described in terms of word statements, and the reason for handling such information is to develop an output or result which suggests a course of action. A methodology was developed for enabling the describing of qualitative relations in such a manner that they can be precisely handled and applied to particular situations, so that a precise course of action can be developed automatically. The processing of a given situation on a computer with respect to such a formulation would result in a prescription for action. By these means highly complicated and interrelated qualitative relations can be handled automatically by the computer. A set of so-called syntax definitions is written which embodies the ideas, concepts, and relations of the particular class of qualitative problems to be considered. These are the overall relations to be applied to any particular situation. The input, or situation, string is a symbolization, usually in terms of ordinary words, of a particular circumstance that is to be analyzed. The input string, together with the syntax list, is used by a computer program called the transtaxor. The report includes computer programs for the transtaxor as coded for the CDC-3600 and the IBM 360/44. TAB

N70-31774# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A MULTICHANNEL MAGNETIC ACCUMULATOR OF ANALOG VALUES

F. F. Belinskis et al 2 Jan. 1970 8 p refs Transl. into ENGLISH from the publ. "Analogovyye Magnitnyye Elementy i Elektromagnitnyye Ustroystva" Moscow, Nauka, 1968 p 46–50 Presented at All-Union Council for Magnetic Components of Automation and Computer Technology, 11th, Tallin, 1966

(AD-702851; FTD-MT-24-413-69) Avail: CFSTI CSCL 9/2

A new signal summer has been developed which is free from the many shortcomings (low accuracy due to different leakage reactances, etc., of individual inputs) of the conventional transformer-type summer. In the new summer, the secondaries of input transformers are connected in series and loaded with individual resistors. The desirable input weight determines the number of turns of the secondary. All input transformers consume equal powers and have the same efficiency. The common secondary circuit is terminated with a high-resistance emitter follower; this circuit carries a current negligible as compared to local secondary currents; hence, the influence of one input on the other is negligible. This influence decreases with the increasing number of inputs. Design formulas are given. TAB

N70-31776# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SEMANTIC ANALYSIS IN MACHINE TRANSLATION

E. F. Skorokhodko 20 Jan. 1970 18 p ref Transl. into ENGLISH from Seminar Avtomatiz. Inform. Rabot i Vopr. Mat. Lingvistiki (USSR), no. 1, 1966 p 29–44

(AD-704201; FTD-MT-24-387-69) Avail: CFSTI CSCL 9/2

It is shown that in machine translation it is not possible in many cases to obtain satisfactory results within the framework of purely formal (morphological and syntaxic) analysis. This refers particularly to the syntaxic and lexical homonomy. An algorithm for syntaxic-semantic analysis is proposed, and its principles of operation are described. The syntaxico-semantic structure is established in the course of this analysis. A special syntaxic analysis is absent, the rules of syntax playing a subordinate part and being used to remove the homonomy. The language of the RX codes is proposed as the intermediary language. Rules of several categories form the basis of the algorithm. Many of the machine-translation rules required can be obtained on a computer. Partial automation of the development of rules can be achieved with the aid of existing algorithms. TAB

N70-31801*# Wolf Research and Development Corp., West Concord, Mass.

INTERACTIVE SPECIFICATION OF DATA DISPLAYS

R. Anderson, R. Bator, R. Gagan, J. Meads, and L. Metrick Washington NASA Jun. 1970 66 p refs

(Contract NAS5-9756)

(NASA-CR-1628) Avail: CFSTI CSCL 09D

The purpose of this research effort was to postulate and experiment with new techniques for interactively creating data displays. The approach discussed in this report was to explore a user oriented language for specifying data display procedures as opposed to data manipulation procedures that could be specified using conventional computer languages such as FORTRAN or ALGOL. In accomplishing this effort the appropriateness of using a list- or string processing language for programming the users language is discussed. A set of data display language operators is proposed and a subset of these were programmed for a PDP-1 with COLOR-CRT display using an interpretive language. Experiments were conducted to obtain user reaction to the concept. Finally, a formal specification of the data display language syntax rules is developed. Author

N70-31803# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALOG-TO-DIGITAL COMPLEX BASED ON DNIEPER-1 AND MN-14 COMPUTERS

A. I. Abramov et al 4 Mar. 1970 11 p Transl. into ENGLISH from Sb. Statei Analogovaya Analogo-Tsifrovaya Vychislitelnaya Tekhn. (USSR), no. 2, 1968 p 9–14

(AD-704026; FTD-MT-24-457-69) Avail: CFSTI CSCL 9/2

A digital-analog complex using the Dnepr-1 and MN-14 computers is described. It is intended primarily for optimizing process control, where the controlled parameters are modeled in the MN-14, and the optimal solution for the controlled variables are obtained by the Dnepr. Examples of control modes are given, which include the computers working singly, in sequence, or in parallel for real-time solutions. TAB

N70-31837# Louisiana State Univ., Baton Rouge. Coll. of Engineering.

MULTIDIMENSIONAL OPTIMIZATION USING PATTERN SEARCH

Charles F. Moore, Cecil L. Smith, and Paul W. Murrill Jan. 1970 14 p

(Contract F44620-68-C-0021; Proj. Themis)

(AD-702842; THEMIS-LSU-T-TR-23; AFOSR-70-0728TR) Avail: CFSTI CSCL 9/2

PATERN is a multidimensional search technique employing essentially a pattern search strategy modified to contain constraints. It is written in general form and can be easily used for virtually all non-linear or parameter optimization problems. PATERN is a deceptively simple optimization program when compared with the more sophisticated techniques. However, it has proven to be one of the best general purpose optimizations programs and is one of the few techniques which can handle virtually any type constraint or boundary on the variables to be searched. PATERN is organized as a subroutine called by a main program. Once called and initiated PATERN minimizes a criterion function, cost, defined by the user in the user written subroutine PROC. Before each functional evaluation PATERN check for constraint violations by calling the user program BOUNDS. After completion of the search PATERN returns the optimum parameters and the minimum criterion function to the main program. Author (TAB)

N70-31881# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A SPECIAL FOR DOCUMENT RETRIEVAL IN A MAGNETIC-TAPE RETRIEVAL SYSTEM

U. I. Selemenov 16 Dec. 1969 14 p Transl. into ENGLISH from Tr. Vsesoyuznaya Konf. po Inform.-Poiskovym Sistemam i Avtomatiz. Obrabotke Nauchno-Techn. Inform. 3d (Moscow), vol. 4, 1967 p 182–188

(AD-702952; FTD-MT-24-256-69) Avail: CFSTI CSCL 9/2

This article contains a description of a specialized code selector which provides retrieval of documents in a descriptor retrieval block on magnetic tape for continuous information reading from the magnetic tapes of the storage system in the Minsk-22 computer. The length of the descriptor code and of the code number assigned to each document was chosen equal to 18 bits, which permits a block of 250 thousand documents. Author (TAB)

N70-31896# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LYaPAS ALGORITHMIC LANGUAGE AND AUTOMATION OF SYNTHESIS OF RELAY SYSTEMS

A. D. Zakrevskiy 6 Jan. 1970 16 p refs Transl. into ENGLISH from Vsesoyuznoe Soveshch. po Avtomat. Upr., Tekhn. Kibernetiki, 3rd Odessa, 1965 (Moscow), 1967 p 321–327

(AD-702953; FTD-MT-24-383-69) Avail: CFSTI CSCL 9/2

In synthesizing relay systems, trial of many versions is unavoidable; hence, the desirability for automating the solution of logic problems included in the synthesis. The LYAPAS (logical language for presentation of synthesis algorithms) language was specially developed for this task. The new language and its accompanying programming system were developed and optimized jointly. Compactness of algorithm presentation, proximity to publication language, maximum use of features of modern general-purpose digital computers, and simplicity of translation into machine languages were the objectives. The language has two levels which differ in quality. The first level is closer to the languages of modern general-purpose computers. At this level, intended for fine structure of algorithms, programs can be set up which are equivalent to 200-300 machine instructions. The second level is intended for presentation of complicated hierarchic-structure programs involving an expandable set of operators and a set of routines. The second-level programs have a much larger capacity than the first-level ones. TAB

N70-31917 Rensselaer Polytechnic Inst., Troy, N.Y.
PARTITIONING ALGORITHMS IN MIXED AND PSEUDOMIXED INTEGER PROGRAMMING
Arnaud L. Henry-Labordere (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-13683

A mixed integer programming problem (MIP), is discussed. A natural partitioning procedure allows the decomposition of the MIP into a pure integer (IP) Master program and a linear programming (LP) subprograms. Two algorithms based on this partitioning are presented. The second implements Bender's scheme by solving the IP Master program by a Gomory cut IP algorithm. It is theoretically shown that Bender's scheme is particularly relevant to solve the Mask Set Selection problem presented in this thesis. Dissert. Abstr.

N70-31920*# Michigan Univ., Ann Arbor. Systems Engineering Lab.
THEORY AND DESIGN OF RELIABLE SPACECRAFT DATA SYSTEMS Quarterly Progress Report, 10 Feb. – 9 May 1970
1 Jun. 1970 70 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952492)
(NASA-CR-110495; QPR-5) Avail: CFSTI CSCL 09B

Continuing research on faults is reported. In the area of permanent memory faults, methods are developed for analyzing a state-assigned machine in terms of the faulty machines. Theorems are proved concerning faults in combinational networks. Further properties of linear machines for the design and diagnosis of experiments were developed, and the concept of path sensitizing in network diagnosis was extended to subgraphs where every path is a sensitized path. N.E.N.

N70-31923# Naval Weapons Lab., Dahlgren, Va.
A DIGITAL FUNCTION GENERATION PACKAGE FOR THE 360 SYSTEM
John Straub Mar. 1970 40 p refs
(AD-703620; NWL-TR-2304) Avail: CFSTI CSCL 9/2

The technical note describes a group of digital computer subroutines which perform function generation. The subroutine package is applicable to functions of one or two independent variables, and is intended for use in a general purpose hybrid computing system. Program listings and detailed flow charts are included. Author (TAB)

N70-31947# Illinois Univ., Urbana.
DEPARTMENT OF COMPUTER SCIENCE Quarterly Technical Progress Report, Oct. – Dec. 1969
1969 241 p refs
(Contract N00014-67-A-0305-0007)
(COO-1469-155; COO-1018-1196) Avail: CFSTI

The LASCOT detection system used to decompose the light from the scanned picture into its primary components is discussed, along with the bundle processor for signal encoding in failsafe operations. The Eidolyzer project machine for extracting features from two dimensional scenes, using a hierarchy of levels and color, was designed. An autonomous processing element is proposed which can communicate with like elements and also derive its operating power from radio waves. Colormatrix test results are summarized involving the thermal behavior of transistors and encapsulated liquid crystals. J.A.M.

N70-31971# California Univ., Berkeley. Electronics Research Lab.
RESEARCH IN MAN-MACHINE COMMUNICATIONS USING TIME SHARED COMPUTER SYSTEMS Summary Report, 1 Jun. 1963 – 30 Mar. 1969
Butler W. Lampson 1 Oct. 1969 76 p refs
(Contract ARPA SD-185; Proj Genie)
(AD-701340; GENIE-R-45) Avail: CFSTI CSCL 9/2

The work of the Genie Project since its inception has been centered around the general subject of man-machine interaction. The main focus throughout has always been on the design and construction of time-sharing systems. A great deal of other work has been supporting this main effort. Most of the work which was not related to the construction of systems has been done using the system which has been constructed. The report is divided into two main parts: the work done between 1964 and 1966, most of which had to do with the creation of the SDS 940 time-sharing system; and the work done between 1967 and 1968, which was much more varied but had a major focus on the design of a new and more elaborate system. TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-31040# Naval Civil Engineering Lab., Port Hueneme, Calif.
DESENSITIZATION OF DC POWER SUPPLIES TO MOMENTARY AC POWER FLUCTUATIONS Technical Report, Jul. 1968 – Jun. 1969
K. T. Huang Jan. 1970 24 p
(AD-700936; NCEL-TR-657) Avail: CFSTI CSCL 10/2

Lightning storms and faults cause momentary voltage dips and momentary power interruptions in the AC power. These brief disturbances reach electronic equipment through fluctuations in the output voltages of DC power supplies. The report describes methods to desensitize DC power supplies to momentary AC power source perturbations. DC output voltage sustaining characteristics for basic transistors and silicon-controlled rectifier power supply circuits are discussed and performance data presented. By the use of an auxiliary energy reservoir circuit, the DC output of a power supply was maintained at its nominally rated value when an AC power interruption of 167 msec occurred. Author (TAB)

N70-31104# National Bureau of Standards, Washington, D.C.
PRECISION MEASUREMENT AND CALIBRATION. VOLUME 3: ELECTRICITY AND LOW FREQUENCY
F. L. Hermach and R. F. Dziuba, eds. Dec. 1968 501 p refs
(NBS-SP-300-Vol-3) Avail: SOD $4.50

Papers are presented on dc and low frequency electrical measurements covering the following topics: electrical units,

electrical standards, standard cells, Zener diodes, resistors, resistance apparatus, capacitors, inductors, instruments, ad-dc transfer standards, transformers, inductive voltage dividers, high voltage measurements, dielectric measurements, and magnetic measurements. For individual titles see N70-31105 through N70-31151. For Vol. 1 see N70-28376 through N70-28415 and for Vol. 2 see N70-29552 through N70-29588.

N70-31109# National Bureau of Standards, Washington, D.C.
ELECTRICAL CALIBRATION ACCURACIES AT NBS: NORMAL AND BEST CAPABILITIES
F. L. Hermach *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 29-32 refs (See N70-31104 16-09)
Avail: SOD $4.50

The National Bureau of Standards concentrates on calibration of electrical standards of high stability and accuracy. Data are given on the present ranges and accuracies of basic electrical measurements, from direct current to 50 kHz. Charts which show accuracies normally available and also the best attainable are included. Author

N70-31110# National Bureau of Standards, Washington, D.C.
SUGGESTED PRACTICES FOR ELECTRICAL STANDARDIZING LABORATORIES
Francis B. Silsbee *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 35-43 refs (See N70-31104 16-09)
Avail: SOD $4.50

A number of basic principles are given that experience has shown to be important in the operation of private standardizing laboratories. Types of standard apparatus are classified and schedules appropriate for their intercomparison and for their checking at the National Bureau of Standards are suggested. Author

N70-31111# National Bureau of Standards, Boulder, Colo. Low Frequency Calibration Services.
ACHIEVEMENT OF MEASUREMENT AGREEMENT AMONG ELECTRICAL STANDARDS LABORATORIES
Frank D. Weaver *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 44-47 refs Submitted for publication (See N70-31104 16-09)
Avail: SOD $4.50

A system of intercomparison is described by which measurement agreement may be achieved among independent laboratories. Desired characteristics of standards and measuring equipment are outlined, and the traceability concept and methods of achieving equality are mentioned. Resistance, voltage, capacitance, and inductance standards are discussed, and the best calibration interval for a given type of standard is considered. N.E.N.

N70-31112# National Bureau of Standards, Washington, D.C.
ELECTRICAL UNITS, INSTRUMENTS, AND MEASUREMENTS
In its Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 48-66 refs (See N70-31104 16-09)
Avail: SOD $4.50

A list of publications is presented which describes the methods and equipment used in the establishment and maintenance of the electrical units and the standards that have been developed at the National Bureau of Standards for the calibration of measuring apparatus. It includes references to older publications of the Bureau which describe basic principles and methods and are therefore still useful. Author

N70-31115# National Bureau of Standards, Washington, D.C. Electrochemistry Section.
THE OPERATING CHARACTERISTICS OF ZENER REFERENCE DIODES AND THEIR MEASUREMENTS
Woodward G. Eicke, Jr. *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 118-124 refs Presented at 18th Ann. ISA Conf. and Exhibit, Chicago, 9-12 Sep. 1963 (See N70-31104 16-09)
Avail: SOD $4.50

A measurement technique with an accuracy in terms of the saturated standard cell of 20 ppm and capable of 2 to 4 ppm accuracy for making stability studies is described. Typical stability data are presented on several diodes. Results of a study of the effect of current and temperature on the output voltage are given, including an equation relating the three variables. The effect of ac components on the dc output is discussed and a cause for this effect is suggested. Also discussed is the electrical noise generated by the diode. Author

N70-31116# National Bureau of Standards, Washington, D.C.
MAKING PRECISION MEASUREMENTS OF ZENER DIODE VOLTAGES
W. G. Eicke, Jr. *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 125-130 refs Reprinted Presented at IEEE-Illinois Inst. of Tech.-Northwestern Univ.-Illinois Univ. Natl. Electron. Conf., Chicago, 28-30 Oct. 1963 (See N70-31104 16-09)
Copyright. Avail: SOD $4.50

The requirements for making precise measurements are considered, methods currently in use are described, and several proposed methods are presented. The methods, in so far as possible, are based on equipment that should be available in standards laboratories. Author

N70-31117# National Bureau of Standards, Washington, D.C.
STABILITY OF DOUBLE-WALLED MANGANIN RESISTORS
James L. Thomas *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 135-139 refs (See N70-31104 16-09)
(NBS-RP-1692) Avail: SOD $4.50

The international ohm is now maintained at the National Bureau of Standards by means of double-walled manganin resistors. It is assumed that the average resistance of a group of 10 standards, selected from a group of 24 constructed in 1933, remains constant with time. Not one of the 10 standards changed in resistance with reference to their average by more than 1 part in a million in 12 years. Author

N70-31118# National Bureau of Standards, Washington, D.C.
ERRORS IN THE SERIES PARALLEL BUILDUP OF FOUR-TERMINAL RESISTORS
Chester H. Page *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 140-148 ref *Its* Paper No. 69C3-197 (See N70-31104 16-09)
Avail: SOD $4.50

The use of n equal resistors in series and in parallel provides an n squared: 1 ratio of potentially high accuracy. Such devices are important for extending the use of the national one-ohm standard to the hundred-ohm, and thence to the 10,000-ohm, level. Formulas are derived for the error in the ratio, expressed in terms of design tolerance, and in terms of first-order residual misadjustments which combine to yield the second-order error of the ratio. It seems feasible to construct a 1:100 ohm buildup device with a ratio uncertainty of less than 1 in 10 to the 8th power. Author

N70-31119# National Bureau of Standards, Washington, D.C.
PRECISION RESISTORS AND THEIR MEASUREMENT
James L. Thomas *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 149-183 refs Reprinted (See N70-31104 16-09)
(NBS-Circular-470) Avail: SOD $4.50

Information is presented on the construction and characteristics of wire-wound resistors of the precision type. There are also included descriptions of the methods used at this Bureau for the test of precision resistors and the calibration of precision resistance

measuring apparatus. Although the presentation is nontechnical, there is a considerable amount of information on the characteristics and limitations of apparatus of this type that should be of interest to any one making accurate measurements of electrical resistance. Author

N70-31120# National Bureau of Standards, Boulder, Colo.
CALIBRATION OF POTENTIOMETERS BY RESISTANCE BRIDGE METHODS
David Ramaley *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 184-186 refs (See N70-31104 16-09)
Avail: SOD $4.50

Convenience and ease in calibration of general-purpose potentiometers is provided by a universal ratio set. Any moderate-sized electrical standards laboratory should consider the procurement of a URS for potentiometer calibrations, especially if other resistance measurements also are required. Author

N70-31121# National Bureau of Standards, Washington, D.C.
NOTES ON THE CALIBRATION OF THE DIRECT READING RATIO SET
Paul P. B. Brooks *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 187-197 (See N70-31104 16-09)
Avail: SOD $4.50

The procedures used in testing and determining the correction for each dial of the direct reading ratio set are outlined. Circuit diagrams of the equipment and alternate methods are included. N.E.N.

N70-31122# National Bureau of Standards, Washington, D.C.
DIRECT RATIO READINGS FROM A URS
David Ramaley and John F. Shafer *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 198-199 refs Reprinted (See N70-31104 16-09)
Avail: SOD $4.50

Modifications to a six-dial universal ratio set are described so that it may be used as a four- or five-dial direct reading ratio set without altering its functioning as a universal ratio set. It is suitable for measuring resistors ranging from about 1 ohm to about 1 megohm. Author

N70-31123# National Bureau of Standards, Boulder, Colo. Radio Standards Lab.
A METHOD OF CONTROLLING THE EFFECT OF RESISTANCE IN THE LINK CIRCUIT OF THE THOMSON OR KELVIN DOUBLE BRIDGE
David Ramaley *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 200-203 refs *Its* Paper No. 64C4-44 (See N70-31104 16-09)
Avail: SOD $4.50

Circuitry of the double bridge is reviewed to emphasize the significance of the link circuit as a part of the bridge network. A simple analysis demonstrates the need of some equivalent or substitute for low link circuit resistance in situations where adequately low link circuit resistance cannot be achieved physically. An appropriate method of controlling the potential difference in the link circuit is shown to accomplish the same effect as an actual reduction of resistance in the link circuit. The simple circuit modifications required to utilize this method are explained. A step-by-step procedure is outlined for making measurements with bridges incorporating these modifications, and some typical examples are discussed illustrating the advantages realized. Author

N70-31124# National Bureau of Standards, Washington, D.C.
METHOD FOR CALIBRATING A STANDARD VOLT BOX
Bernadine L. Dunfee *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 204-216 refs *Its* Paper No. 67C1-114 (See N70-31104 16-09)
Avail: SOD $4.50

The ratios of a volt box are measured against those of a standard using a difference technique. The standard volt box used possesses those design features required for a ratio standard and lends itself to a self-calibration technique. A method is described for measuring its ratios at rated and above rated voltage to an accuracy of 10 parts per million or better using a direct reading ratio set and a group of resistance standards. Although the method is described in its particular application to the NBS standard it can be used equally well in the measurement of other ratio networks. Errors that might appear in the measurements and procedures for evaluating their magnitudes are outlined and the derivation of a general expression that defines all ratios in terms of measured quantities is presented. Author

N70-31126# National Bureau of Standards, Washington, D.C. Electricity Div.
A METHOD FOR CALIBRATING VOLT BOXES, WITH ANALYSIS OF VOLT-BOX SELF-HEATING CHARACTERISTICS
Ronald F. Dziuba and T. Michael Souders *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 222-230 refs Reprinted (See N70-31104 16-09)
Avail: SOD $4.50

A modification of the Julie ratiometric method is described. It proves to be a useful calibration method, featuring speed of operation and high accuracy while requiring only an inexpensive and versatile ratio standard. The method is limited to the calibration of volt boxes whose self-heating errors are within the desired accuracy range. However, with the production of volt boxes designed to decrease the self-heating errors by decreasing the rated current (higher ohms per volt characteristic) and by using resistance materials having lower temperature coefficients, the method could be increasingly useful for calibrating working volt boxes quickly and easily, to an accuracy within 10 ppm. Author

N70-31127# National Bureau of Standards, Washington, D.C.
IMPROVED TEN-PICOFARAD FUSED SILICA DIELECTRIC CAPACITOR
R. D. Cutkosky and L. H. Lee *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 237-243 refs Sponsored in part by Navy *Its* Paper No. 69C3-196 (See N70-31104 16-09)
Avail: SOD $4.50

Some defects in a set of fused silica dielectric capacitors constructed in 1961 are listed, and methods for their reduction or elimination are described. The construction of a new set of capacitors completed in 1964 is described in detail. Preliminary stability data presented indicate that the typical drift of the 1964 capacitors with respect to their mean was less than two parts in 10 to the 7th power in five months. Author

N70-31128# National Bureau of Standards, Washington, D.C.
VOLTAGE DEPENDENCE OF PRECISION AIR CAPACITORS
J. Q. Shields *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 (See N70-31104 16-09) refs *Its* Paper No. 69D4-207
Avail: SOD $4.50

Methods are presented for measuring both the relative and absolute voltage dependence of admittance standards. The practical circuits based on the methods are composed of precision bridges which are described in detail. Measurements with these circuits yield values for the proportional changes in admittance which result from specified changes in voltage. The results of measurements on selected capacitors are presented. Uncertainties are of the order of one part in 10 to the 9th power. A general instability in the voltage dependence of precision air capacitors was observed at the higher accuracy levels. Most of the instability is believed to be caused by changes in the electrode surfaces. Author

N70-31129# National Bureau of Standards, Boulder, Colo.
CAPACITOR CALIBRATION BY STEP-UP METHODS
Thomas L. Zapf *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 254-258 refs *Its* Paper No. 64C1-27 (See N70-31104 16-09)
Avail: SOD $4.50

The excellent precision of repetitive substitution procedures is exploited by step-up or step-down methods to extend measurements to higher or lower magnitudes without serious degradation of accuracy. The application of step-up techniques to the calibration of variable air capacitors is described as a practical example of the method. Author

N70-31130# National Bureau of Standards, Boulder, Colo. Radio Standards Lab.
CALIBRATION OF INDUCTANCE STANDARDS IN THE MAXWELL-WIEN BRIDGE CIRCUIT
Thomas L. Zapf *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 259-264 refs *Its* Paper No. 65C3-69 (See N70-31104 16-09)
Avail: SOD $4.50

The errors from residuals in the Maxwell-Wien bridge and the effect of these on the measurement of inductors in a bridge not having a Wagner ground are discussed. Particular attention is given to the use of substitution methods for accurate measurements and especially to the equal-substitution (comparison) method, which can yield excellent precision in the calibration of inductance standards. Author

N70-31131# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
SOME TECHNIQUES FOR MEASURING SMALL MUTUAL INDUCTANCES
D. N. Homan *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 265-270 refs *Its* Paper No. 70C4-233 (See N70-31104 16-09)
Avail: SOD $4.50

A method of measuring small mutual inductances is presented. The smallest inductor measured was 0.1 microhenry. The circuit is a transformer-ratio-arm bridge with multiple balances and is described in detail. Uncertainties are of the order of one part in 10 to the 7th power. Several ideas for the design and construction of suitable mutual inductance standards are presented. Author

N70-31132# National Bureau of Standards, Washington, D.C.
THE ac-dc TRANSFER INSTRUMENTS FOR CURRENT AND VOLTAGE MEASUREMENTS
Francis L. Hermach *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 275-280 refs Reprinted (See N70-31104 16-09)
Avail: SOD $4.50

Descriptions are presented on three types of instruments: electrodynamic, which depend upon the force between current-carrying conductors; electrostatic, which depend upon the force between charged conductors; and electrothermic, which depend upon some effect produced by the heating of a current-carrying conductor. Response equations are given for the torque of the instrument and the opposing torque. Other instruments used in conjunction with the transfer instruments are also mentioned. N.E.N.

N70-31133# National Bureau of Standards, Washington, D.C. Electricity Div.
THERMAL CONVERTORS FOR AUDIO-FREQUENCY VOLTAGE MEASUREMENTS OF HIGH ACCURACY
F. L. Hermach and E. S. Williams *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 281-289 refs Presented at Conf. on Precision Electromagnetic Meas., Boulder, Colo., 1966 Sponsored in part by Army and Navy (See N70-31104 16-09)
Avail: SOD $4.50

The ac-dc differences of a reference group of thermoelements were evaluated at audio frequencies to a few parts per million (ppm) at currents from 5 to 20 mA. A technique for comparing the ac-dc differences of two thermoelements with an uncertainty of about 2 ppm was developed. Two 5 mA thermoelements are used with a plug-in set of resistors of computable reactances to form thermal voltage converters for voltage measurements. With this same technique adjacent ranges of these converters can be compared to step up from 0.5 to 500 V to better than 10 ppm. Author

N70-31134# National Bureau of Standards, Washington, D.C. Electrical Instruments Section.
A SYSTEM FOR ACCURATE DIRECT AND ALTERNATING VOLTAGE MEASUREMENTS
F. L. Hermach, J. E. Griffin, and E. S. Williams *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 290-299 refs Reprinted Sponsored in part by Army and Navy (See N70-31104 16-09)
Avail: SOD $4.50

A system for calibrating and using a group of dc and ac standards was developed to meet increasing needs for greater accuracy in the measurement of direct and rms alternating voltages at audio frequencies. With a group of saturated cells, a universal ratio set as a potentiometer, a simplified self-calibrating volt box, and a new differential-thermocouple ac-dc comparator, an accuracy of 10 ppm can be obtained for direct voltage measurements and 40 ppm for rms alternating voltage measurements between 20 and 20,000 c/s, in terms of the direct volt and the ac-dc transfer standards maintained at NBS. Author

N70-31135# National Bureau of Standards, Washington, D.C.
A COMPARATOR FOR THERMAL ac-dc TRANSFER STANDARDS
Raymond S. Turgel *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 300-309 refs Presented at 21st Ann. ISA Conf. and Exhibit, New York, 24-27 Oct., 1966 Submitted for publication *Its* Instr. Soc. of Am. Preprint No. 12.3-1-66 (See N70-31104 16-09)
Avail: SOD $4.50

Thermal transfer standards are calibrated by intercomparison with standards of known ac-dc difference. A comparator is described that simplifies such routine calibrations. A sequence of null balances in the measuring circuit operates a simple analog computer which indicates the result of the intercomparison directly in parts per million of ac-dc difference. Author

N70-31136# National Bureau of Standards, Washington, D.C.
CALIBRATION OF PEAK A-C TO D-C COMPARATORS
Donald Flach and Louis A. Marzetta *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 310-317 refs Presented at 20th ISA Conf. and Exhibit, Los Angeles, 4-7 Oct. 1965 Submitted for publication *Its* Instr. Soc. of Am. Preprint No. 14.2-3-65 (See N70-31104 16-09)
Avail: SOD $4.50

Two methods are described for testing peak ac to dc comparators at the 10 and 20 volt level over a frequency range of 50 Hz to 4800 Hz. These two methods yield results which agree well within 50 parts per million. Author

N70-31137# National Bureau of Standards, Washington, D.C.
A DIFFERENTIAL THERMOCOUPLE VOLTMETER
J. F. Griffin and F. L. Hermach *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 318-323 refs Reprinted Presented at AIEE Middle Eastern District Meeting, Wilmington, Del., 7-9 May 1962 *Its* Paper 62-819 (See N70-31104 16-09)

Copyright. Avail: SOD $4.50

An ac voltmeter was developed to indicate directly the percentage difference between an unknown voltage and the settings of the instrument dials. It is accurate to 0.05% from 5 cps to 10 kc within the voltage range from 1 to 700 volts. Two 10-ma thermoelements are used; one in series with an ac decade resistor, and the other energized from a constant-voltage dc source, a Zener diode. A built-in galvanometer, calibrated in % of input voltage, indicates the difference between the two thermocouple-output emfs, and has a resolution of more than 0.01%. The instrument was designed for rapidly calibrating other voltmeters, but it can be used also for ac-dc difference measurements (frequency response tests) to 0.02%. Author

N70-31138# National Bureau of Standards, Washington, D.C. Electricity Div.

AN INTERNATIONAL COMPARISON OF CURRENT-RATIO STANDARDS AT AUDIO FREQUENCIES

Bernadine L. Dunfee and W. J. M. Moore (NRC of Can., Ottawa) *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 329-334 refs (See N70-31104 16-09)
Avail: SOD $4.50

The results and analysis of an intercomparison between the National Research Council (NRC), Canada, and the National Bureau of Standards (NBS), Washington, D.C., of two contrasting types of current ratio standards (current comparator and current transformer) are presented. The agreement achieved between the two laboratories when their respective designs and methods of measurement were quite different is emphasized. To this end, the basic theories underlying the design and operation of the current comparator and current transformer are contrasted; the origin and significance of their respective errors are summarized; the (N+1) method used at NBS to measure the errors of the multirange transformer standards up to 10 kHz is contrasted with the (N+1) method (one of several) used at NRC in calibrating the comparator standards. The comparison circuit used at NRC to compare the respective standards of the two laboratories is described. The errors of the transformers as measured at NBS and NRC are presented and contrasted in both tabular and graphical forms. Author

N70-31139# National Bureau of Standards, Washington, D.C.

COMPARATORS FOR VOLTAGE TRANSFORMER CALIBRATIONS AT NBS

Wilbur C. Sze *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 335-341 refs *Its* Paper No. 69C4-206 (See N70-31104 16-09)
Avail: SOD $4.50

An inductive comparator is described for measuring ratio-correction-factor and phase-angle error of voltage transformers by comparison with reference transformers. The simple circuit utilizes a resistance-capacitance network and an inductive voltage divider. The relative magnitude of the ratio-correction-factors is obtained from the dial readings of the inductive voltage divider, and the phase angle between the voltage phasors is equal to + or − omega CR. The accuracy of these measurements at 60 and 400 hertz is within 2 parts-per-million for ratio and within 10 microradians for phase angle at the limits of the phase-angle range of + or − 38 milliradians. Only a few ranges of reference transformers are required since fractional ratios from 1/1 to 1/4 may be measured as readily as ratios near unity, without diminution in accuracy. A general discussion of a resistive comparator, which has been in continuous operation since 1939, is included. Author

N70-31140# National Bureau of Standards, Washington, D.C.

AN INTERNATIONAL COMPARISON OF VOLTAGE-TRANSFORMER CALIBRATIONS TO 350 kV

F. K. Harris, W. C. Sze, N. L. Kusters (NRC of Can., Ottawa), O. Petersons (NRC of Can., Ottawa), and W. J. M. Moore (NRC of Can., Ottawa) *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 342-348 refs Reprinted Presented at IEEE Summer Gen. Meeting and Nucl. Radiation Effects Conf., Toronto, 16-21 Jun. 1963 *Its* Paper 63-992 (See N70-31104 16-09)
Copyright. Avail: SOD $4.50

Calibration tests made at the United States National Bureau of Standards (NBS) and the National Research Council of Canada (NRC) are reported. The transformer is a cascade type consisting of three sections, each with a separate core and primary winding encased in a porcelain cylinder. In a previous comparison, the agreement between NRC and NBS results at ratios of 1000:1 and higher was between 100 and 300 ppm, based in both laboratories on resistive voltage dividers whose voltage coefficients of ratio could be evaluated only to a rough approximation. In the present comparison the results agree between the laboratories within 20 ppm at ratios to 4000:1 and voltages to 350 kV, except for the 1200:1 ratio where the transformer instability made the measurements less meaningful. It may therefore be said that an improvement of an order of magnitude was achieved, and that ratio and phase-angle measurements on voltage transformers are now reliable in either laboratory within 20 ppm and 10 microradians at voltages to 350 kV. Author

N70-31141# National Bureau of Standards, Washington, D.C.

THE PRECISION MEASUREMENT OF TRANSFORMER RATIOS

R. D. Cutkosky and J. Q. Shields *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 349-356 refs Reprinted Presented at Conf. on Std. and Electron. Meas., 1960 *Its* Paper No. 5-4 (See N70-31104 16-09)
Avail: SOD $4.50

The voltage ratio at the points of interconnection independent of mutual coupling and ground impedances within the capacitor housing are shown to be obtained directly under the following conditions. Eleven nominally equal three-terminal capacitors are mounted in good thermal contact with each other and with their detector leads connected together, and eleven balances are made with the line lead of each capacitor in turn on the high voltage side of a 10:1 transformer and the other ten line leads on the low voltage side. Mathematical discussions are given of the theory of permutation method, lead impedance corrections, and transformer design. N.E.N.

N70-31142# National Bureau of Standards, Boulder, Colo. Radio Standards Lab.

COMPARISON CALIBRATION OF INDUCTIVE VOLTAGE DIVIDERS

Raymond V. Lisle (RCA, Patrick AFB, Fla.) and Thomas L. Zapf *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 357-361 refs Presented at 18th Ann. ISA Conf. and Exhibit, Chicago, 9-12 Sep. 1963 (See N70-31104 16-09)
Avail: SOD $4.50

Calibrated inductive voltage dividers serve as excellent standards of voltage ratio for use in the comparison calibration of other ac voltage dividers. Differences in phase angles in the dividers can be accommodated by the production of a voltage in the detector circuit in quadrature with the reference voltage. The comparison circuit, the handling of stray impedances, guarding, measurement procedures, quadrature voltage production, and errors are discussed. The comparison method can be used in standardizing laboratories for the calibration of inductive voltage dividers and other voltage ratio equipment. Author

N70-31143# National Bureau of Standards, Washington, D.C.

COMPARATOR FOR CALIBRATION OF INDUCTIVE VOLTAGE DIVIDERS FROM 1 TO 10 kHz

Wilbur C. Sze *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 362-370 refs Presented at 21st Ann. ISA Conf. and

Exhibit, New York, 24 - 27 Oct. 1966. Submitted for publication. Sponsored in part by Navy. Instr. Soc. of Am. Preprint No. 12.3-2-66. (See N70-31104 16-09)
Avail: SOD $4.50

A high accuracy comparator is described for measuring the relative deviations in voltage ratios and phase angles of inductive voltage dividers. The new technique overcomes several inherent limitations of the existing comparison methods. The balance is accomplished by utilizing special shielded transformers and a resistance-capacitance network for in-phase and quadrature voltage injections. The measurements are accurate to within 10 to the -7th power of input in the frequency range from 1 to 10 kHz. Resolution is better than 2 × 10 to the -10th power. Author

N70-31144# National Bureau of Standards, Washington, D.C. Electricity Div.
AN INTERNATIONAL COMPARISON OF INDUCTIVE VOLTAGE DIVIDER CALIBRATIONS AT 400 AND 1000 Hz
W. C. Sze, A. F. Dunn (NRC of Can., Ottawa), and T. L. Zapf. *In its* Precision Meas. and Calibration, Vol. 3, Dec. 1968, p 371 - 378, refs. (See N70-31104 16-09)
(NRC-8284) Avail: SOD $4.50

The results of an international comparison of a seven-decade inductive voltage divider by the United States National Bureau of Standards and the National Research Council of Canada are reported. The calibration techniques used in each laboratory are discussed in detail, and the results of calibration at 400 and 1000 Hz are compared. The accuracies of measurements are within 0.1 ppm of input for voltage ratio. Author

N70-31145# National Bureau of Standards, Washington, D.C.
SPECIAL SHIELDED RESISTOR FOR HIGH-VOLTAGE dc MEASUREMENTS
J. H. Park. *In its* Precision Meas. and Calibration, Vol. 3, Dec. 1968, p 383 - 388. *Its* Paper No. 66C1-83. (See N70-31104 16-09)
Avail: CFSTI

A large number of individually shielded, one-megohm wire-wound resistors connected in series and arranged to form a vertical helix between a ground plate and a high voltage electrode. The individual shields completely enclose each one-megohm resistor and prevent formation of corona at the surface of the resistance coil. The vertical helical configuration with a large hat, or high-voltage electrode, on top serves to prevent concentration of electric field and corona formation at the high-potential end of the resistor. An experimental method of checking for corona or leakage errors at high values of voltage consisted of accurately comparing the current in at the high voltage end of the resistor with the current out at the ground end of several different values of applied voltage. These measurements together with others performed to check temperature and leakage errors indicated that the value of resistance for the 100-megohm unit remains constant to within about 10 ppm for voltages up to 50 kV. Author

N70-31146# National Bureau of Standards, Washington, D.C.
SHUNTS AND INDUCTORS FOR SURGE-CURRENT MEASUREMENTS
John H. Park. *In its* Precision Meas. and Calibration, Vol. 3, Dec. 1968, p 389 - 412, refs. (See N70-31104 16-09)
(NBS-RP-1823) Avail: SOD $4.50

The special requirements that must be fulfilled by a shunt intended to be used in surge current measurements are explained. A tubular shunt with coaxial potential leads that meets these requirements is described, and factors affecting its design are discussed. A theoretical derivation of the skin effect in this type of shunt at high frequencies is given. The advantages of using a mutual inductor for obtaining oscillograms of the rate of change of current during a surge are outlined, and several types of mutual inductors developed especially for this purpose are described. Theoretical derivations indicate that the concentric-tube mutual inductors can be used to measure the high frequency components of a current surge up to 70 megacycles with less than 10 percent error. Several shunts and mutual inductors were constructed for use in the high voltage laboratory. Their complete description and oscillograms showing results obtained with them are included. Author

N70-31147# National Bureau of Standards, Washington, D.C.
SPARK-GAP FLASHOVER MEASUREMENTS FOR STEEPLY RISING VOLTAGE IMPULSES
J. H. Park and H. N. Cones. *In its* Precision Meas. and Calibration, Vol. 3, Dec. 1968, p 413 - 423, refs. Its Paper No. 66C3-96. (See N70-31104 16-09)
Avail: SOD $4.50

Two designs of thin ribbon resistors were devised which are suitable for high-voltage surges and have very low time constants. They were used in making up dividers for measuring linearly rising chopped impluses with peak voltages up to 300 kilovolts and times to sparkover from 0.03 to 50 microseconds. Errors in divider ratio due to residual inductance were found by computation to be less than 1 percent. Stray capacitance errors were kept low by making total divider resistance 1,000 ohms or less. By a combination of computation and experimentation, capacitance errors were deduced to be not greater than 1 percent for times to sparkover 0.1 microsecond or greater. A large number of oscillograph records were obtained of spark-gap flashover voltage with linearly rising voltage impulses at rates of rise up to 10,000 kilovolts per microsecond. From these oscillograms data were derived giving a relation between rate of rise (or rise time) and flashover voltage for (1) 12.5-cm-diameter spheres spaced 6 cm apart, (2) 25-cm-diameter spheres spaced 6 cm, and (3) 6.5-inch-diameter uniform field electrodes spaced 5 cm. Volt-time curves showing these relations were plotted. Author

N70-31149# National Bureau of Standards, Washington, D.C.
TWO-TERMINAL DIELECTRIC MEASUREMENTS UP TO 600 MHz
Martin G. Broadhurst and Anthony J. Bur. *In its* Precision Meas. and Calibration, Vol. 3, Dec. 1968, p 431 - 438, refs. *Its* Paper No. 69C3-195. (See N70-31104 16-09)
Avail: SOD $4.50

A two-terminal dielectric specimen holder was constructed and used to make dielectric constant and loss measurements on a single disk specimen at room temperature over a frequency range from .01 Hz to 600 MHz. The measurement procedures are outlined and a detailed analysis of the working equations and measurement errors is presented. Author

N70-31150# National Bureau of Standards, Washington, D.C.
BASIC MAGNETIC QUANTITIES AND THE MEASUREMENT OF THE MAGNETIC PROPERTIES OF MATERIALS
R. L. Sanford and I. L. Cooter. *In its* Precision Meas. and Calibration, Vol. 3, Dec. 1968, p 439 - 476, refs. (See N70-31104 16-09)
(NBS-Monograph-47) Avail: SOD $4.50

General information is presented regarding the two basic quantities, magnetic induction and magnetizing force, and also the magnetic constant. Information is also given regarding the magnetic properties of various materials and methods and apparatus commonly used for measuring these properties by means of reversed direct current or alternating currents of low frequency. Magnetic measurements peculiar to high frequencies are not discussed. In view of the gradual adoption of the rationalized MKSA system of units, this system is included as well as the classical cgs electromagnetic system. Author

N70-31382# Radiation, Inc., Melbourne, Fla.
COMPLEMENTARY BIPOLAR DEVICES Final Technical Report, Mar. 1968 - Mar. 1969
Gordon R. Taylor Griffiss AFB, N.Y. RADC Dec. 1969 106 p refs
(Contract F30602-68-C-0255)
(AD-704168; RADC-TR-69-243) Avail: CFSTI CSCL 9/1

The fabrication of monolithic complementary bipolar switching transistors which are dielectrically isolated is described and the electrical characteristics of the devices are evaluated. The preparation of dielectrically isolated material with N on N+ and P on P+ collector regions is presented along with the diffusion processing used to fabricate the NPN and the PNP transistors in this material. The electrical characteristics of the complementary device pairs obtained are reported. The matching of the electrical parameters of these complementary device pairs is discussed. The variation in the parameter matching with temperature and device diffusion profile is also discussed. Author (TAB)

N70-31442# Rensselaer Polytechnic Inst., Troy, N.Y. Div. of Electrophysics.
BULK SEMICONDUCTOR LIMITERS Quarterly Progress Report, 1 Jun. - 31 Aug. 1969
K. E. Mortenson, J. N. Park, A. Armstrong, R. Gutmann and P. Bakeman Feb. 1970 34 p refs
(Contract DAAB07-69-C-0186)
(AD-703893; ECOM-0186-2; QPR-2) Avail: CFSTI CSCL 9/5

The report discusses the progress made toward the optimization of the existing X-band, silicon microwave limiter component and the development of a similar Ku-band microwave limiter component. X-band devices were designed and fabricated which provide small low level insertion loss along with increased isolation at high power levels and increased power handling capability. Also discussed are the fabrication and test results for a GaAs limiter device mounted in a simple resonant iris limiter at Ku-band is presented and the low level test results are discussed. The devices meet the low level specifications of the supporting contract. Several X-band silicon limiter devices were mounted in simple resonant irises and encapsulated with a suitable resin. A small but acceptable increase in low level insertion loss was noted along with an increase in incident power level without gaseous arcing. Author (TAB)

N70-31489# Harry Diamond Labs., Washington, D.C.
A FLUIDIC SYSTEM FOR MEASURING CURRENT IN BRIDGE WIRES
Jonathan E. Fine Jan. 1970 34 p ref
(AD-704327; HDL-TM-70-1) Avail: CFSTI CSCL 13/7

A fluidic system for sensing current and transmitting this information is being developed to measure current induced in electronic circuits by radiofrequency electromagnetic radiation. The system consists of two temperature-sensitive fluidic oscillators, one of which is heated by the current to be measured while the other produces a reference signal. The beat frequency which results from summing the signals from the two oscillators is amplified with fluidic proportional amplifiers and transmitted acoustically out of the radiation environment. The breadboard system can measure direct currents up to 100-mA. Currents of 18 mA were detected with a sensitivity of 1 Hz/mA. In the present system, two amplifiers per meter of length were required to transmit the signal. Author (TAB)

N70-31581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF SYSTEM DESIGN FOR MAGNETIC DECISION ELEMENTS
M. A. Rozenblat et al 18 Dec. 1969 32 p refs Transl. into ENGLISH from the Russian
(AD-702955; FTD-MT-24-217-69) Avail: CFSTI CSCL 9/5

The article examines the factors determining extreme static and dynamic characteristics of magnetic decision elements, as well as certain new principles for the design of these elements, permitting as substantial improvement in their characteristics and expansion of the area where it is expedient to use them in automatic control systems. The topics treated are line diagrams of magnetic decision amplifiers, statistical characteristics of summation amplifiers, functional converters, dynamic characteristics of summation magnetic decision amplifiers, and magnetic analog storage and integrating devices. TAB

N70-31618# Sylvania Electric Products, Inc., Seneca Falls, N.Y. Electronic Tube Div.
COMPACT FIVE-GUN CATHODE RAY TUBE Final Report, 1 Jul. 1968 - 31 Oct. 1969
George E. Hassler Fort Monmouth, N.J. Feb. 1970 43 p refs
(Contract DAAB07-68-C-0429)
(AD-702933; ECOM-0429-F; Rept-1) Avail: CFSTI CSCL 9/1

The objective of this contract was to develope a compact five-gun cathode ray tube similar to the JAN-7YP2, but restricted to an overall length of 12 inches. Initial efforts during this period were directed towards design and tooling of a suitable glass envelope, a short compact cluster with five electron guns, a mu-metal shield, and associated electrical hardware. The final efforts during this time interval were directed towards successful construction and delivery of two prototype cathode ray tubes. Author (TAB)

N70-31648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF VARIOUS GASES ON THE THERMIONIC EMISSION OF TANTALUM WIRE FILAMENTS
Thomas M. Heslin, John J. Park, and Edward L. Sanford Washington Jul. 1970 13 p refs
(NASA-TN-D-5850; G-981) Avail: CFSTI CSCL 20C

Oxygen and nitrous oxide decrease the thermionic emission of yttrium-doped tantalum wire used as neutralizer filaments in cesium-ion microthrusters. This finding resulted from experiments prompted by the emission-limited behavior of neutralizers at unexpectedly low voltages during microthruster testing on one of the Applications Technology Satellites. Author

N70-31719# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
ELECTRONIC MODELING OF UNIDIRECTIONAL SERVOMOTOR
G. L. Baranov *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 151 - 162 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

An electronic model is developed for a unidirectional servomotor speed control system for diesel generators allowing for nonlinear consumption characteristics of slide valves, load variations, and piston motion direction. The model is convenient for investigating servomotors under various rod work loads and control modifications from the valve side. Transl. by E.C.

N70-31746*# Boeing Co., Seattle, Wash. Aerospace Group.
LITERATURE SEARCH AND RADIATION STUDY ON ELECTRONIC PARTS Final Report
W. E. Horne May 1970 258 p refs Prepared for JPL
(Contract NAS7-100; JPL-952565)
(NASA-CR-110486; D2-126203-3) Avail: CFSTI CSCL 09E

A survey has been made of radiation effects literature pertinent to effects of low-level steady-state neutron, gamma, and proton environments on electronic components. A bibliography of over 300 references was compiled. The data were scanned and an analysis made of the radiation effects state-of-the-art for electronic components on a deep space mission that might be exposed to planetary radiation belts and to on-board radioisotope thermoelectric

generator environments. Emphasis was placed on permanent parameter degradation, temporary parameter drifts, parameter degradation factors, hardening techniques, and screening techniques. Author

N70-31817# Texas Instruments, Inc., Dallas.
SURFACE WAVE DEVICES Annual Technical Report, 15 Jan. 1969 – 15 Jan. 1970
Lewis T. Claiborne, Clinton S. Hartmann, and Stanley W. Jones Mar. 1970 148 p refs
(Contract N00014-69-C-0173)
(AD-702776; TI-08-70-16) Avail: CFSTI CSCL 9/1

An important aspect of any program for the study of surface waves is calculation of the phase and group velocities and the elastic and electric field patterns. Surface wave propagation has been under investigation both theoretically and experimentally for several substrate materials. A formalism was developed to calculate surface wave phase and group velocities for different crystal symmetries. Of particular interest is the character of the roots of the wave equation for the various regions of slowness space. Convergence of the real and the imaginary parts of the determinant formed from the boundary conditions has been investigated. Of particular interest are the calculations for one new material, Ba2NaNb5O15. Velocity measurements have been made for elastic waves at the surface of CdS, ZnO, LiNbO3, GaAs, Si, and Ba2NaNb5O15. Limited measurements of attenuation have also been made. The spreading of a surface wave beam has been treated in both near and far field regions. The prototype correlation and compression filter studies are discussed. A mathematical model has been formulated for the response of a dispersive surface wave transducer array. Application areas for surface wave matched filters for radar signal processing have been identified. TAB

N70-31849*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
PRIMARY LOOP: ELECTROMAGNETIC PUMP DESIGN
J. W. Gahan, P. T. Pileggi, and A. H. Powell Washington NASA Jun. 1970 113 p refs
(Contract NAS3-1604)
(NASA-CR-1571; GESP-337) Avail: CFSTI CSCL 13K

An analysis of different types of electromagnetic pumps for pumping lithium through the reactor (primary) loop of a Rankine cycle space power system has been completed. Five basic types of pumps were analyzed and screened, including a DC conduction, an AC single phase induction, a three-phase flat, an annular linear, and a helical induction design. A sixth design, which is a modification of the three-phase helical induction design but with fluid entrance and exit from the same end of the pump, was selected by NASA for the detail design study. The specific application required a pump capable of 30 lb/sec flow rate, and a 20 psi developed head, with 2100 F lithium. The pump which has resulted from the design work is approximately 50 in. long, 16 in. in diameter, weighs 1000 lb, and has an overall efficiency of 16 percent. Author

N70-31997*# ITT Federal Labs., Fort Wayne, Ind. Tube and Sensor Labs.
RESEARCH IN THE DEVELOPMENT OF AN IMPROVED MULTIPLIER PHOTOTUBE Final Report
E. H. Eberhardt and P. R. Henkel 21 May 1970 46 p refs
(Contract NASw-1855; ITT Proj. 1123700)
(NASA-CR-110521; ITT-ETD-70-006) Avail: CFSTI CSCL 09A

The absolute quantum counting efficiency (counts out/quantum in) of a multiplier phototube is measured. Despite the evident importance of this parameter in evaluating the performance of quantum counting detectors, surprisingly few direct measurements have been made, presumably because of the experimental difficulties involved, and the lack of quantum counting capability of many multiplier phototubes. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-31024*# Northeastern Univ., Boston, Mass. Electronics Research Lab.
A STUDY OF MICROMINIATURIZED DEVICES FOR BIOASTRONAUTICAL MONITORING OR ANALYSIS Research Report, 1 Mar. 1969 – 31 Mar. 1970
B. L. Cochrun and J. S. Rochefort 1 Apr. 1970 25 p refs
(Grant NGL-22-011-024)
(NASA-CR-86411; RR-4) Avail: CFSTI CSCL 09C

Active filter synthesis using RC distributed networks, d-c to d-c converters, digital filters and measurement techniques using pulsed solid-state light diodes are discussed. URC and ERC networks and their use in active filter circuit synthesis are discussed. D-c to d-c converters have been developed that are capable of operating at voltages less than 1.35 volts and having dual polarity outputs using only a single polarity input. A successful analogue digital synthesis of a third degree Butterworth filter has been realized. In order to make the circuit more suitable to monolithic integrated-circuit techniques a novel approach utilizing deficit charging and capacitance amplification is currently under development. An analysis of the pulsed light diode method of measurement has made it possible to be more definitive in specifying the desired characteristics for the light emitting diodes. Author

N70-31414# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TODAY'S RADIO ELECTRONICS
9 Jan. 1970 5 p Transl. into ENGLISH from Radio (Moscow), no. 5, 1969 p 1
(AD-704057; FTD-HT-23-6-70) Avail: CFSTI CSCL 9/3

The directives of the 23rd Congress of the CPSU regarding the Five-Year-Plan for the Development of the National Economy of the USSR for the 1966-1970 period call for accelerating growth rates in a number of production sectors, including that of radio and electronics, to a large degree determinant of the nations scientific and technological progress. In recent years, important achievements have been reached in the further development of this branch of industry. A wide range of electronic devices and systems have been created for science, industry, and agriculture which are assisting the people of the Soviet Union in their successful building of a Communist society. Author (TAB)

N70-31640# California Univ., Livermore. Lawrence Radiation Lab.
TIRED VOLT OR HOW DID A GOOD VOLT GET THAT WAY?
W. E. Bostwick 5 Feb. 1970 17 p refs Presented at Instr. Soc. of Am. 1969 Ann. Conf., Houston, Tex., 27–30 Oct. 1969 Submitted for publication Sponsored by AEC Revised
(UCRL-71935-Rev-1; Conf-691004-2) Avail: CFSTI

A load/time test was performed using saturated cells with ten kilohms/sec as the starting load and time. Load tests were performed daily, with curves showing a change in volts before and after the tests. J.A.M.

N70-31658# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LENINGRAD INSTITUTE OF ELECTRICAL ENGINEERING NEWS, NO. 61, 1966
A. A. Kalnin et al 30 Jan. 1970 17 p refs Transl. into ENGLISH from Izv. Elektrotekhn. Inst. (Leningrad), no. 61, 1966 p 26–34
(AD-704044; FTD-HT-23-625-69) Avail: CFSTI CSCL 9/3

Contents: Growth of alpha-form silicon carbide from solutions; and Obtaining silicon carbide-based p-n junctions from solutions.
TAB

N70-31673 Arizona Univ., Tucson.
LINEAR SWEEP SQUARE WAVE VOLTAMMETRY
Matthew Stephen Krause, Jr. (Ph.D. Thesis) 1969 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-18335

The electroanalytical technique of linear sweep square voltammetry was investigated at the hanging mercury drop electrode. The time potential wave form consisted of a linear sum of a square wave of half period tau and a synchronized staircase voltage function of period 2 tau. Sweep rates of 0.1 to 0.005V/sec were investigated. The construction of a transistorized operational amplifier three-electrode potentiostat, along with the appropriate solid state timing and sampling circuits, is described. A comparison of the observed currents as a function of the various operating parameters for the iron(III) oxalate showed excellent agreement with theoretical predictions. Detection limits and peak resolution were found to be comparable to that of square wave polarography. The technique was found to be a rapid, sensitive analytical tool. Current linearity of 1% was observed over a thousand-fold concentration range. Dissert. Abstr.

N70-31678 Ohio State Univ., Columbus.
EVALUATION OF SEVERAL METHODS FOR LARGE-SIGNAL STABILIZATION OF CONDITIONALLY STABLE SYSTEMS WITH SATURATION
Richard Charles Rapson, Jr. (Ph.D. Thesis) 1969 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-22193

A conditionally stable linear system is stable for a range of gain values, but becomes unstable for gains above or below known values. A saturable nonlinearity in series with the conditionally stable linear system can effectively behave as a gain reduction when subjected to large signals. When such a nonlinear system is operated at large signal levels the problem of stability arises. Four methods of providing stability were investigated theoretically and supported by analog computer simulations. The four methods were stabilization by minor-loop feedback around the saturation, stabilization by system type-switching based on error level, stabilization by state variable feedback, and stabilization by input pre-filtering. Dissert Abstr.

N70-31720# Akademiya Nauk URSR. Kiev. Inst. Elektrodinamiki.
SATURATION FACTOR IN CALCULATIONS OF ELECTROMECHANICAL TRANSIENT PROCESSES
V. N. Avramenko *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Sytems 1968 p 163–166 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Computer-aided analysis of saturation in synchronous mechanisms is discussed on the basis of Gorev-Park equations for transient processes in power systems. The dependence of the reactivity of the armature on the resulting magnetomotive force is defined in terms of machine characteristics in the idle mode.
Transl. by E.C.

N70-31721# Akademiya Nauk URSR. Kiev. Inst. Elektrodinamiki.
STANDARD MODES OF DYNAMIC MODELS OF POWER SYSTEMS FOR EXPERIMENTAL VERIFICATION OF METHODS FOR CALCULATING STABILITY AND TRANSIENT PROCESSES
Yu. Ya. Mezhennyj *In its* Appl. of Computers for Analysis of the Stability and Short-Circuit Currents in Elec. Power Systems 1968 p 167–174 refs In RUSSIAN (See N70-31701 16-08)
Avail: CFSTI

Methods are discussed for obtaining experimental data to correlate results of calculations of power supply circuit operating conditions taking into account multiple circuit parameters. Procedures are described for an experiment to determine the limits of statistical stability of a generator, with and without automatic excitation control, operating through a circuit line on a busbar of infinite power. Transl. by E.C.

N70-31861*# Radio Corp. of America, Somerville, N.J. Electronics Components.
VALIDATION OF MONOLITHIC CIRCUIT TEST STANDARDS THROUGH AN INTEGRATED COS/MOS MULTIPLEXER Final Report, 25 Jun. 1968 – 31 Dec. 1969
R. Mao and R. Feryszka Mar. 1970 95 p
(Contract NAS8-21440)
(NASA-CR-102735) Avail: CFSTI CSCL 09A

The multiplexers used as a vehicle to test the validity of the proposed test standard that was designed for process control and testing of monolithic circuits is described. This standard is a compilation of test methods selected from various programs for microelectronic and new technology developed during the study is listed. F.O.S.

N70-31874*# Philco-Ford Corp., Blue Bell, Pa.
STUDY OF FAILURE MODES OF MULTILEVEL LARGE SCALE INTEGRATED CIRCUITS
Earl S. Schlegel Washington NASA Jun. 1970 109 p refs
(Contract NAS12-544)
(NASA-CR-1567; SR-4) Avail: CFSTI CSCL 09C

Empirical and theoretical investigations of the factors that affect the fundamental electrical properties of the Si-SiO2 interface have resulted in techniques for improving the reliability and performance of large scale multilevel microcircuit arrays. A new set of test structures has been prepared to evaluate the fundamental electrical properties of oxide-silicon interfaces of the types likely to be found in large scale multilevel microcircuit arrays. This set was designed for use on wafers with production MOS microcircuits. The set includes a sufficient number of test structures to represent each type of region in a microcircuit. The set includes both new test structures and previously existing structures redesigned to have improved sensitivity. A discussion is given of the considerations involved in the design of each test structure in the set and of problems that arise in their use. An additional effect of the introduction of a second layer dielectric has been postulated.
Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-30818# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
EXTRA FLOODLIGHTING AND FLASH SIMULATION IN THE F104G FLIGHT SIMULATOR AT VOLKEL [EXTRA PANEELUERLICHTING EN FLITSSIMULATIE IN DE F104G FLIGHTSIMULATOR TE VOLKEL]
J. Boogaard and J. J. Voss [1969] 8 p In DUTCH; ENGLISH summary
(IZF-1969-17) Avail: CFSTI

To reduce the effects of flash blindness it was investigated how the dashboard illumination in the F104G might be raised to

1500 lux. Such lighting was installed in the F104G flight simulator at Volkel. A flash simulator was built to make the pilot experience flash blindness during training in the flight simulator. Author

N70-30940# Coast Guard, Baltimore, Md. Field Testing and Development Center.
FEASIBILITY TEST FOR DCB-24R GREEN ACRYLIC FILTER
L. R. Lomer and G. P. Clark Washington 6 Mar. 1970 13 p refs
(AD-702765; Rept-505) Avail: CFSTI CSCL 17/7

A green acrylic filter made from 3/16-inch plexiglass was tested with a DCB-24R Searchlight Beacon with 1000-watt and 2000-watt tungsten-halogen lamps. The tests yielded a transmissivity in excess of fifty percent, a chromaticity too pale to qualify as a Signal Green, and high temperature effects on the acrylic filter. Author (TAB)

N70-30986*# Techtran Corp., Glen Burnie, Md.
NEW INSTALLATIONS FOR INVESTIGATING THE VESTIBULAR ANALYZER
V. N. Barnatskiy et al *In its* Physiol. of the Vestibular Analyzer Jun. 1970 p 210 - 212 refs (See N70-30951 16-04)
Avail: CFSTI CSCL 14B

The four-beam swing used at present is simultaneously a stimulator of the otoliths and semicircular canals. An installation is proposed in which the horizontal component of acceleration is eliminated in order to reduce to a minimum stimulation of the semicircular canals. A motor is used to oscillate the cabin. The installation makes it possible to study the effects of optokinetic stimuli. Author

N70-31184# Stanford Linear Accelerator Center, Calif.
TWO-MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Oct. - 31 Dec. 1969
Mar. 1970 65 p refs
(Contracts AT(04-3)-400; AT(04-3)-515)
(SLAC-116) Avail: CFSTI

A status report on the Stanford linear accelerator project covering the period October 1, 1969 to December 31, 1969 is presented. Topics included are accelerator and research area operations, accelerator and research area equipment development, and physics research equipment development. Author (NSA)

N70-31388 European Organization for Nuclear Research, Geneva (Switzerland).
CENTRAL GEOMETRY STUDY OF THE SYNCHRO-CYCLOTRON WITH "CALUTRON" HAVING HIGH FREQUENCY EXTRACTIONS [ETUDE DE LA GEOMETRIE CENTRALE DU SYNCHRO-CYCLOTRON AVEC SOURCE 'CALUTRON' A EXTRACTION HAUTE FREQUENCE]
S. Comiti and R. Giannini 1970 60 p refs In FRENCH; ENGLISH summary
(CERN-70-9) Copyright. Avail: Issuing Activity

By means of a detailed analysis of the first orbits, a central geometry is proposed that maximizes the acceptance and minimizes the radial oscillations. An electrolytic tank is built to compute the orbits with good accuracy. An electric field measurement in three dimensions allows computation of the vertical motion of the proton with space-charge effects included. An internal beam current of about 20 microamperes is foreseen after machine conversion. Author

N70-31393# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT, 63 Technical Report, Jul. - Sep. 1969
Kenneth C. Crebbin and Don M. Evans 21 Nov. 1969 9 p refs
(Contract W-7405-eng-48)
(UCRL-19399) Avail: CFSTI

The Bevatron provided beam to 16 experiments this quarter and accelerated a total of 1.83×10 to the 18th power protons. A new thin-septum magnet (0.130 in.) was installed in the east straight section of the first magnet in the EPB system. This magnet is compatible with the present energy-loss extraction system and will be used to continue resonant-extraction studies. A quadrupole magnet was also installed just downstream from this septum magnet. Extraction efficiency using the energy-loss system is now about 50%. Computer control of the external beam transport magnets was expanded to include control of more magnets and more versatile programming options. The control system was also expanded toward eventual control of the pulse modes of the Bevatron magnet power supply. Author (NSA)

N70-31883*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDY OF CONDITIONS LIMITING V/STOL TESTING IN WIND TUNNELS WITH SOLID FLOOR
Harry H. Heyson Washington Jun. 1970 329 p refs
(NASA-TN-D-5819; L-7042) Avail: CFSTI CSCL 14B

Under sufficiently large wake deflections, the forward portion of the wake is found to flow forward along the floor leading to a vortex pattern which results in Rae's limits. Although wind-tunnel data cannot normally be corrected successfully beyond these limits, it may be possible to obtain ground-effect data for conditions more severe than those implied by Rae. Author

N70-31926# ARO, Inc., Arnold Air Force Station, Tenn.
BOUNDARY INTERFERENCE IN A RECTANGULAR WIND TUNNEL WITH PERFORATED WALLS Final Report, Jan. - Aug. 1969
C. F. Lo and R. H. Oliver AEDC Apr. 1970 54 p refs Submitted for publication
(Contract F40600-69-C-0001)
(AD-704123; AEDC-TR-70-67) Avail: CFSTI CSCL 14/2

The boundary interference at subsonic speeds is presented for rectangular wind tunnels with perforated walls. The point-matching method is used for the analysis with an equivalent homogeneous boundary condition at the perforated walls. Numerical results are given for rectangular wind tunnels having various porosities and height-to-width ratios of 1.0, 0.8, and 0.5. Author (TAB)

N70-31961*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 1: BURST DISCS, TASK 1 Final Technical Report
J. Martinez Nov. 1969 249 p refs
(Contract NAS10-6098)
(NASA-CR-107240; KSC-TR-1040) Avail: CFSTI CSCL 22D

A detailed study of the burst discs installed in the vacuum annulus of cryogenic transfer lines of Launch Complex 39 is discussed. A search of test history, failure data, and the conditions leading up to the failures that had been experienced in the field prior to, during, and subsequent to space vehicle launch were investigated. Conclusions based on hardware evaluation, product review, new design, and comprehensive testing are discussed and recommendations to improve burst disc design and installation are presented. Author

N70-31962*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 2: VACUUM SEAL VALVES Final Technical Report
J. Martinez 12 Dec. 1969 103 p refs
(Contract NAS10-6098)
(NASA-CR-107241; KSC-TR-1041) Avail: CFSTI CSCL 22D

Results are presented of a detailed study of the seal-off

vacuum valves used in the propellant and vent lines on the launch tower service arms at Kennedy Space Center. Phase I of the study sought to develop improved valve designs to overcome residual leaks and poor resealability, thereby eliminating excessive field maintenance. Hardware was evaluated, valve failure histories were searched, a state-of-the-art product review was made, and designs were studied. Improvements in materials, configurations, and seal port designs were sought. Phase II was a testing program for valves manufactured under new specifications incorporating the improvements resulting from Phase I studies. Environmental factors and possible operational problems were simulated to determine that the newly developed valve materials and designs would meet all requirements for a satisfactory 5-year minimum life in a seacoast environment. Author

N70-31963*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 3, SUB-TASK 1: VACUUM JACKETED HOSE FLEXURE Final Technical Report
Ken Kimble Oct. 1969 168 p refs
(Contract NAS10-6098)
(NASA-CR-107242; KSC-TR-1042) Avail: CFSTI CSCL 22D

A detailed study is given of the vacuum jacketed flex lines that are routed across the retractable service arms on the launch/umbilical tower to supply cryogenic fluids to the Saturn 5 vehicle. These lines experience severe heat transfer and motion conditions during operational service and abuse during handling and installation which result in premature failure of components and high frequency of maintenance and attendant costs. Conclusions based on hardware evaluation, product review, new designs and comprehensive testing are discussed and recommendations to increase the performance, durability, flexibility, and reliability of these lines by developing improvements in design, construction, and/or usage are presented. Author

N70-31964*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 3, SUB-TASK 2: VACUUM AND CO2 JACKETED LINE REPAIR TECHNIQUES Final Technical Report
K. Kimble Jan. 1970 241 p refs
(Contract NAS10-6098)
(NASA-CR-107243; KSC-TR-1043) Avail: CFSTI CSCL 22D

Results of a study of repair techniques for vacuum and CO2 jacketed transfer lines on the service arms of the launch umbilical tower at Launch Complex 39 are presented. To develop better procedures to be used by operations personnel to make on-site repairs, various types of problems were analyzed. Literature and patent searches were made, manufacturers and users were interviewed, material samples and data were studied, and state-of-the-art leak detection methods were investigated. Tests simulating field conditions were performed on prepared sample repairs, and vacuum integrity was checked. Further testing on promising materials was performed under conditions simulating actual jacketed line repairs. Adverse environmental factors, internal pressure, ruggedness, and flexural fatigue life were studied. Maintenance histories, failure analyses, and field conditions should all be used in determining repair procedures. It was recommended that further study be conducted on new materials technology advancement and on leak detection equipment. Use of transfer lines utilizing modular concepts for ease of maintenance and repair was also recommended. Author

N70-31965*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY TASK 4: ROTARY JOINT Final Technical Report
R. C. Mursinna 28 Nov. 1969 138 p refs
(Contract NAS10-6098)
(NASA-CR-107244; KSC-TR-1044) Avail: CFSTI CSCL 22D

The purpose was to develop a low heat leak cryogenic rotary coupling capable of 360 deg rotation. The first phase covered a period of six months and consisted of completing the design tasks. The second phase covered a period of nine months and consisted of fabricating and testing one 8-inch inside diameter vacuum jacketed rotary joint. One 6-inch inside diameter jacketed rotary was also fabricated. The vacuum jacketed rotary joint concept proved entirely practical for transfer of liquid oxygen or liquid hydrogen across rotating interfaces. The heat leak was not greater than that experienced with vacuum jacketed having bayonet joints. The space envelope required did not exceed that for conventional ring-joint flanges. Author

N70-31966*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 5: VACUUM PROBES Final Technical Report
G. R. Rewerts 5 Jan. 1970 122 p refs
(Contract NAS10-6098)
(NASA-CR-107245; KSC-TR-1045) Avail: CFSTI CSCL 22D

The results of the evaluation study for vacuum probes are presented. Areas of study covered in Phase I were hardware evaluation, a state-of-the-art investigation, and a design phase. Phase II consisted of a test program which basically included environmental testing of vacuum probes already in production. The test specimens underwent all environments found at Cape Kennedy during standby and launch conditions. Results of the hardware evaluation of the thermocouple vacuum probes at Launch Complexes 34 and 39 showed a reliability of 0.8400. Failure was due mostly to vibration, shock, and corrosion. The study and test results indicate that attainment of reliability of 0.91 is within present state-of-the-art and 0.96 is likely. Several types of vacuum measuring devices were investigated and the conclusion was that the thermocouple device was the most practical for the launch complex environment. Upgrading of resistance to shock, vibration, and corrosion was found necessary. Author

N70-31967*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 6: CENTRAL VACUUM PULLDOWN SYSTEM Final Technical Report
G. R. Rewerts 7 Apr. 1969 128 p refs
(Contract NAS10-6098)
(NASA-CR-107246; KSC-TR-1046) Avail: CFSTI CSCL 22D

Results are presented of a study for a central pulldown system to be used on the service arms of the launch umbilical tower at Launch Complex 39. Areas studied included hardware evaluation, installation feasibility, product review of presently available vacuum system hardware, state-of-the-art investigation, and design. The design phase was followed by a proposal containing the test plan, procurement plan, and cost summary. An analysis of series and parallel manifold systems was made, and the results are included. The applicability of a vacuum ion pump to maintain high vacuum in the annulus of the jacketed line segment was studied, and it was decided that an empirical evaluation would be necessary before final conclusions could be made. Use of stainless steel for system components that would withstand corrosive atmospheric conditions was recommended. Author

N70-31968*# AMETEK/Straza, El Cajon, Calif.
VACUUM JACKETED UMBILICAL LINES TECHNOLOGY ADVANCEMENT STUDY. TASK 7: BAYONET JOINT Final Technical Report
R. C. Mursinna 28 Nov. 1969 129 p refs
(Contract NAS10-6098)
(NASA-CR-107247; KSC-TR-1047) Avail: CFSTI CSCL 22D

A detailed study was made of the bayonet joints located in the cryogenic propellant and vent lines routed across the

retractable service arms on the launcher umbilical tower. These lines contain numerous bayonet joints to permit disassembly for repair and ease of installation. These joints have experienced damage during assembly due to misalignment and the heavy, cumbersome nature of the line to which they are attached. As a result of comprehensive evaluation and testing of the existing hardware, it was concluded that simplification of this hardware and improvement in joint assembly methods are necessary to reduce damage, reduce replacement rate, and still maintain the required level of insulation. Two new units, one 8-inch diameter and one 6-inch diameter vacuum jacketed bayonet joint test section, were developed during this study which successfully met all of the primary design goals. Author

N70-31976*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOHELIOGRAPH THERMAL VACUUM OPTICAL TEST CHAMBER, NOVEMBER 1967 - JUNE 1968
R. Hahn 12 Aug. 1968 9 p
(Contract NAS7-100)
(NASA-CR-110248; JPL-750-9) Avail: CFSTI CSCL 14B

The design requirements and instrumentation are outlined for the chamber to test the ATM photoheliograph. The configuration with the laser unequal path interferometer is briefly described. The requirements include a vacuum of .0001 torr, solar radiation of 133 watts/sq ft, an interface between the main spar at 70 F and the canister at 50 F, and a low vibration environment. N.E.N.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-30609*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
GAS FLOW APPARATUS, APPENDIX H
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 6 p (See N70-30602 16-33)
Avail: CFSTI CSCL 20D

The gas flow apparatus used to determine the specific mass flow conductance is described. The experimental apparatus was constructed to obtain data on gas pressure drop and mass gas flow through insulation systems with the gas in viscous, transition, and free molecular conditions. Insulation specimens were constrained in a manner similar to that occurring on an actual installation. Provision was made for cryogenic cooling of the insulation. Author

N70-30639# Avco-Everett Research Lab., Everett, Mass.
RADIATION FROM AIR-TEFLON BOUNDARY LAYERS
R. A. Greenberg, K. L. Wray, L. A. Young, and N. H. Kemp Mar. 1970 59 p refs
(Contract F04701-68-C-0036; ARPA Order 1092)
(AD-702804; AERL-AMP-294; SAMSO-TR-70-44) Avail: CFSTI CSCL 20/6

Radiation profiles in an ablating flat plate air-teflon laminar boundary layer were studied both experimentally and theoretically. The experiments were conducted in a one atmosphere, 3000 - 6000K, subsonic free stream produced by an arc jet. Spatially resolved radiation profiles within the boundary layer were obtained in both the visible and near infrared. Spatially integrated boundary layer radiation was measured in the 4 - 10 micron region. The major radiation in the visible and near ultraviolet wavelengths was the CN violet. In the infrared, the major radiators were CO, CO2, NO and COF2. The theory which was developed to predict the structure included coupling of the heat and mass transfer at the Teflon surface. A partial equilibrium model for the teflon-air chemistry was utilized, which does not allow the formation of CF3 and CF4 within the boundary layer. For the selected wavelengths in the infrared the theory generally predicted quite well both the spatial location and magnitude of the peak radiation, and also predicted the integrated radiation across the layer to within a factor of two. For the selected wavelength in the visible, the radiation intensity, which comes from CN, is much larger than predicted, indicating that the CN is not in thermodynamic equilibrium. Author (TAB)

N70-30669# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ON THE LABORATORY SIMULATION OF SMALL-SCALE ATMOSPHERIC TURBULENCE
G. R. Ludwig and T. R. Sundaram Dec. 1969 63 p refs
(Contract AT(30-1)-4038)
(CAL-VC-2740-S-1; NYO-4038-1) Avail: CFSTI

The results of an investigation of the methods and requirements for the laboratory simulation of small scale atmospheric turbulence near the ground are presented. Theoretical studies were performed to determine the degree of simulation of the atmospheric surface layer which is required to obtain meaningful results. In addition, an experimental study of our mechanical ability to generate a laboratory flow which meets the theoretical requirements was performed. The results, which have been limited to consideration of the neutrally stable atmosphere, are very encouraging. This is particularly true with regard to the mechanical generation of flows which simulate the lower atmosphere. Author

N70-30814*# Lockheed Missiles and Space Co., Huntsville, Ala.
INVESTIGATION OF THE STEADY EXPANSION OF A GASEOUS AXISYMMETRIC JET INTO A VACUUM Final Report
S. J. Robertson [1970] 96 p refs
(Contract NAS8-21490)
(NASA-CR-102726; LMSC/HREC-D162317; HREC-1490-2) Avail: CFSTI CSCL 20D

Noncontinuum flow characteristics in the jet plume, including the corner expansion at the nozzle lip, are studied. A method-of-characteristics solution of rarefied monatomic gaseous jet expansion into a vacuum is presneted. Experimental investigations of low density plumes are discussed. N.E.N.

N70-30815*# Lockheed Missiles and Space Co., Huntsville, Ala.
METHOD-OF-CHARACTERISTICS SOLUTION OF RAREFIED MONATOMIC GASEOUS JET EXPANSION INTO A VACUUM
In its Invest. of the Steady Expansion of a Gaseous Axisymmetric Jet into a Vacuum [1970] 48 p refs (See N70-30814 16-12)
(LMSC/HREC-D148961; HREC-1490-1) Avail: CFSTI CSCL 20D

An analytical investigation was made of rarefied gas flow in an axisymmetric jet, including the corner expansion, exhausting into a vacuum. A set of partial differential equations was derived for a single-component, monatomic gas by taking moments of the Boltzmann equation with the BGK approximation of the collision integral. The resulting partial differential equations were solved numerically by the method of characteristics. A set of equations describing flow around a sharp corner (Prandtl-Meyer) was obtained by applying the method of characteristics equations to a round corner and allowing the finite radius to approach zero through a limiting process. The accuracy of the solution was verified by making calculations for a spherical source flow expansion and comparing the results with those obtained by another analytical technique. The technique was then applied to the calculation of uniform parallel flow from a Mach 3.0 nozzle exhausting into a vacuum with throat Reynolds numbers of 25 and 100. Author

N70-30816*# Lockheed Missiles and Space Co., Huntsville, Ala.
EXPERIMENTAL INVESTIGATIONS OF LOW DENSITY

PLUMES

Leonard Bogdan *In its* Invest. of the Steady Expansion of a Gaseous Axisymmetric Jet into a Vacuum [1970] 35 p refs Prepared by Cornell Aeron. Lab., Inc. (See N70-30814 16-12)
(CAL-AA-2794-Y-1) Avail: CFSTI CSCL 20D

A description is presented of an experimental study conducted for the purpose of measuring gas number density in the near field of a low density plume at high altitude. Using short-duration testing and measurement techniques, number densities in helium plumes were determined with the electron beam fluorescence probe. A description of the instrumentation, calibration, apparatus, and test procedures is given together with a summary of the test data obtained. Successful use of unconfined electron beams of six-foot length for diagnostic application was demonstrated. Author

N70-30827*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF BLADE LEADING EDGE THICKNESS ON CAVITATION PERFORMANCE OF 80.6 DEG HELICAL INDUCER IN HYDROGEN

Royce D. Moore and Phillip R. Meng Washington Jun. 1970 22 p refs
(NASA-TN-D-5855; E-5445) Avail: CFSTI CSCL 20D

Three different 80.6 helical inducers were tested in hydrogen over a range of liquid temperatures and flow coefficients. These inducers were identical in design except for the blade leading edge thickness. Although no consistent trend was observed with thickness, the required net positive suction head NPSH for each thickness increased with increasing flow coefficient and decreased with increasing liquid temperature. The predicted thermodynamic effects of cavitation varied with blade leading edge thickness. Two cavitation parameters that qualitatively evaluate the cavitation performance of inducers were developed. Author

N70-30942# General Electric Co., Philadelphia, Pa. Space Div.

THE CALCULATION OF THE FORMATION OF DISCONTINUITIES IN PLANAR AND SPHERICALLY-SYMMETRIC NONISENTROPIC INVISCID FLOWS

Paul Gordon and Sinclaire M. Scala Mar. 1970 51 p refs Supercedes DOC-69SD1; See N69-30302
(AD-702666; DOC-70SD5; DOC-69SD1) Avail: CFSTI CSCL 20/4

The possibility of the occurrence of discontinuities in inviscid flows governed by the Euler equations is a well-recognized phenomenon, and artificial viscosity techniques have been developed to overcome the associated difficulties. In the paper, the following two questions were investigated: (1) Is it possible to utilize a numerical scheme for the inviscid equations, for both isentropic and nonisentropic flows, such that the stability of the method does not depend on an artificial viscosity effect. (2) Is it possible to have continuous nonisentropic, inviscid flows in which there are subsonic and supersonic regions. The results of three numerical studies indicate that the finite difference representation that was utilized to solve the Euler equations is stable, even in the presence of mathematical discontinuities, and that this stability is not due to what is commonly referred to as an artificial viscosity. Also, it was found that regions of varying entropy remain continuous, although mathematical discontinuities are formed at later times in the regions of constant entropy. Author (TAB)

N70-30945*# Scientific Translation Service, Santa Barbara, Calif.

INABILITY OF A SHOCK WAVE ACCELERATED INTERFACE BETWEEN TWO GASES [NEUSTOYCHIVOST GRANITSY RAZDELA DVUKH GAZOV, USKORIAYEMOY UDARNOY VOLNOY]

Ye. Ye. Meshkov Washington NASA Jun. 1970 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), Sep.-Oct. 1969 p 151-158
(Contract NASw-2035)
(NASA-TT-F-13074) Avail: CFSTI CSCL 20D

Experimental investigation of the stability of an interface between two gases in the case where a shock wave passes through this boundary. It is shown that the interface becomes unstable regardless of whether the shock wave passes from a light to a heavy gas or from a heavy to a light gas. The disturbance of the interface increases linearly with time in the first approximation. Author

N70-30946*# Techtran Corp., Glen Burnie, Md.

APPLICATIONS OF SELF-SIMILAR SOLUTIONS FOR BOUNDARY LAYER LINEARIZATION EQUATIONS [ISPOLZOVANIE AUTOMODELNYKH RESHENIY DLYA LINEARIZATSII URAVNENIY POGRANICHNOGO SLOYA]

A. Sh. Dorfman et al Washington NASA Jun. 1970 14 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, 1969 p 90-97
(Contract NASw-2037)
(NASA-TT-F-12955) Avail: CFSTI CSCL 20D

A method for computing a laminar boundary layer based on the joint solution of an equation of motion, linearized using some one-parameter family of profiles, and an integral relation is reviewed, and a solution of the problem with an arbitrary velocity distribution at the layer boundary is presented. Author

N70-30948*# Minnesota Univ., Minneapolis. Heat Transfer Lab.

INTERACTION OF A HEATED JET WITH A DEFLECTING STREAM Summary Report

J. W. Ramsey and R. J. Goldstein Apr. 1970 74 p refs
(Contract NAS3-7904)
(NASA-CR-72613; HTL-TR-92) Avail: CFSTI CSCL 20D

An experimental investigation of the interaction of a heated jet with a deflecting flow has been performed in a wind tunnel. The secondary (jet) flow is introduced at angles of 90 and 35 deg to the mainstream flow direction. Visualization studies using tufts of yarn and a carbon dioxide-water fog are reported. Temperature profiles in the interaction region are presented for blowing rates (ratio of mass flux of injected gas to mass flux of freestream) from 0.1 to 2.0 for normal injection and at blowing rates of 1.0 and 2.0 for 35 degree injection. Velocity and turbulence intensity profiles are reported for normal injection at blowing rates of 1.0 and 2.0. Author

N70-31054# Addis Translations International, Woodside, Calif.

SYSTEMS OF QUASILINEAR EQUATIONS AND THEIR APPLICATIONS TO GAS DYNAMICS, SECTIONS 5-9

B. L. Rozhdestvenskii et al Jan. 1970 48 p Transl. into ENGLISH from the book "Sistemy Kvazilineinykh Uravnenii i Ikh Prilozheniya k Gazovoi Dinamike" Science Press, Moscow, 1968 p 407-435 Prepared for California Univ., Livermore. Lawrence Radiation Lab.
(UCRL-Trans-10446) Avail: CFSTI

Approximate gas dynamic equations with artificial viscosity ensuring the smoothing of the shock front were formulated. The computational formulas should be essentially similar in form, and should approximate the conservation laws so that the final result approximates the generalized solutions both in the region of smooth flow, where it approximates the exact gas dynamic equations, and on discontinuities, where it approximates the Hugoniot condition (property of the strong approximation). Since the computational formulas are essentially similar in form, flows in the smooth region can be computed in the same way as in the region of discontinuity and this leads to the appearance of the approximating viscosity. It follows that the computational scheme presupposes the presence of discontinuities in each computational interval and the construction of computational formulas that take the possible discontinuities into account. Author

N70-31059*# General Applied Science Labs., Inc., Westbury, N.Y.
SOME ASPECTS OF VISCOUS CHEMICALLY REACTING MODERATE ALTITUDE ROCKET EXHAUST PLUMES Final Report
R. B. Edelman, M. J. Abbett, G. Wellerstein, O. Fortuna, and J. Genovese Mar. 1970 159 p refs
(Contract NAS8-21264)
(NASA-CR-102747; GASL-TR-737) Avail: CFSTI CSCL 20D

An analytical study of several processes relevant to the structure of moderate altitude rocket exhaust plumes is presented. The work covers an analytical framework for a viscous and chemically reacting plume; the Mach disc, the mixed flow problem, and condensation effects. Author

N70-31172# European Space Research Inst., Frascati (Italy).
INTERACTION OF SHOCK WAVES WITH CONTACT DISCONTINUITIES
J. F. Mc Kenzie [1970] 16 p ref Submitted for publication
Avail: CFSTI

It is shown that the outcome of the interaction of a shock wave with a contact discontinuity as given by Courant and Friedrichs (1948), is in error. When a shock wave in one gas hits a second gas with a higher sound speed at a contact discontinuity, a rarefaction wave is reflected and a shock is transmitted. In the case where the second medium has a lower sound speed than the first, a reflected and a transmitted shock results. Author (ESRO)

N70-31210# Argonne National Lab., Ill. Chemical Engineering Div.
PULSED-BED APPROACH TO FLUIDIZATION
Masaru Kobayashi (Ph.D. Thesis - Northwestern Univ.) Oct. 1969 157 p refs
(Contract W-31-109-eng-38)
(ANL-7592) Avail: CFSTI

An important objective of this investigation is to explore pulsed-bed characteristics that result from controlled, intermittent gas flow. Four sizes of glass beads were tested in 4-in.-OD, 1.25-in.-ID annular columns to find the unique characteristics of pulsed beds. Results of the investigation showed that the bed expansion ratios increase with gas velocity and decrease with pulse frequency and fraction of on-period; good particle motion exists below the minimum fluidizing velocity; and the stroke of the bed can be predicted from on-period, gas velocity, and minimum bubbling velocity. The characteristics of heat transfer from an internal heater to a pulsed bed have been studied regarding the effects of pulsing conditions, particle and gas properties, heater position, heater length, and static-bed height. Pulsed-bed operation has remarkable advantages in a heat transfer process with large sizes and heavier particles, short heaters, and heaters located in the upper part of a bed. With the proposed heat transfer mechanism model and the predicted bed stroke, the heat transfer coefficients in a pulsed bed can be estimated. Author

N70-31274# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
THE LANGEVIN EQUATION OF WEAK TURBULENCE
Klaus Elsesser and Pitter Graeff (Inst. fuer Plasmaphysik) Mar. 1970 50 p refs
(MPI/PAE-Astro-32) Avail: CFSTI

The hierarchy equations describing weakly interacting waves in a fluid were solved by the method of characteristic functionals, combined with the time asymptotic method of Bogoliúbov and Mitropolski. The result to lowest nontrivial order allows one to characterize the stochastic state of the fluid in close analogy to the Brownian motion of a test particle. The pure Gaussian case and the realizability conditions of the full approximation scheme are also discussed. It is clear that for the lowest order the positivity of the probability measure is ensured because of the existence of the model equation mentioned above. Author (ESRO)

N70-31280# Stanford Univ., Calif. Dept. of Mechanical Engineering.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: AN EXPERIMENTAL STUDY OF THE FLUID DYNAMICS WITH STRONG FAVORABLE PRESSURE GRADIENTS AND BLOWING
R. J. Loyd, R. J. Moffat, and W. M. Kays May 1970 186 p refs
(Grant NSF GK-2201)
(HMT-13) Avail: Issuing Activity

Profiles of the mean velocity and the streamwise component of the fluctuating velocity was obtained for blown and unblown turbulent boundary layers subjected to strong accelerations. A similarity solution is presented for the laminar boundary layer equations for constant K flows with transpiration at constant F. The natural coordinates of the similarity solution are used for comparing the turbulent mean velocity data and skin friction coefficients. The turbulent profiles move toward the laminar solution as K is increased but away from the laminar solutions as F is increased. Short of retransition, the asymptotic skin friction coefficient increases with increasing values described here can be adequately predicted by a mixing length model damped by a modified form of the Van Driest damping function. A correlation is presented for the dimensionless constant which appears in the argument of the damping function. Author

N70-31319# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
AN EXPERIMENTAL STUDY OF THE EFFECT OF SOLID PARTICLES ON THE PRESSURE AT BLADE SURFACES IN CASCADE
W. Tabakoff and M. Hussein Mar. 1970 38 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-703896; THEMIS-70-8; AROD-T-4-13-E) Avail: CFSTI CSCL 21/5

Data representing the effect of solid particle flow on the pressure distribution over blade surfaces in cascade are presented. Various inlet mass flow concentrations were tested. Different particle sizes were used, namely 50, 300 and 1000 microns, in order to determine their effect on the pressure distribution. Author (TAB)

N70-31320# Naval Ship Research and Development Center, Washington, D.C.
FLUTTER OF A TWO-DEGREE-OF-FREEDOM HYDROFOIL IN TWO-DIMENSIONAL SUBCAVITATING FLOW Final Report
Daniel S. Cieslowsi and Peter K. Besch Jan. 1970 47 p refs
(AD-704100; NSRDC-3183) Avail: CFSTI CSCL 13/10

Four hydrofoil flutter tests were performed in a towing basin and a 36-inch water tunnel using a two-degree-of-freedom hydrofoil in two-dimensional flow. Mass ratio, mass unbalance, heave stiffness, angle of attack, and foil depth were varied. All of these parameters significantly affected the flutter boundaries. Comparisons were made with a flutter theory based on the Theodorsen analysis. Theory gave good flutter predictions at high mass ratios but failed at low mass ratios. Author (TAB)

N70-31347# Naval Ordnance Lab., White Oak, Md.
A TIME-DEPENDENT QUASI-ONE-DIMENSIONAL ANALYSIS OF POPULATION INVERSIONS IN AN

EXPANDING GAS Final Report
John D. Anderson, Jr. 12 Dec. 1969 43 p refs
(AD-703214; NOLTR-69-200) Avail: CFSTI CSCL 20/4

A time-dependent technique for the numerical solution of convergent-divergent, nonequilibrium nozzle flows was used to analyze the rapid, vibrational nonequilibrium, supersonic expansion of CO2-N2-H2O and CO2-N2-He mixtures, wherein the finite rate molecular energy transfer processes can result in a population inversion between the (001) and (100) vibrational energy levels of CO2. Results for such population inversions are presented. Among these, a comparison was made between the present results and the recent results of Basov et al; this comparison indicates that Basovs calculations overestimate the population inversion in an expanding mixture of CO2 and N2. In addition, results are presented from a series of numerical experiments conducted to assess the validity of several simplified methods for computing population inversions. Author (TAB)

N70-31400*# Scientific Translation Service, Santa Barbara, Calif.
ACCOUNTING FOR LOSSES DUE TO RANDOM JET FLOW MIXING IN HYDROJETS [OB UCHETE POTER PRI SLUCHAYNOM SMESHENII POTOKOV V KAMERAKH GRD]
I. M. Chernyy et al Washington NASA Jun. 1970 10 p refs Transl. into ENGLISH from Gidromekhan. (USSR), no. 15, 1970 p 89-93
(Contract NASw-2035)
(NASA-TT-F-13073) Avail: CFSTI CSCL 20D

Theorems in continuum mechanics are applied to the determination of the energy losses arising due to mixing of the primary and secondary flows in mixing chambers. The efficiency of three representative mixing chamber versions is analyzed as a function of the secondary flow parameters and the ratio of inlet velocities. A formula for calculating energy losses due to mixing is proposed. Author

N70-31460# Oakland Univ., Rochester, Mich.
THERMOMAGNETIC EFFECTS IN RAREFIED GASES Final Report, 1 Sep. 1968 - 1 Sep. 1969
Robert M. Williamson 1 Sep. 1969 19 p refs
(Grant DA-ARO(D)-31-124-G1064)
(AD-703021; AROD-7833-2-P) Avail: CFSTI CSCL 20/4

The report constitutes a summary of an experimental study of a newly discovered thermomagnetic gas torque: in chambers with varied dimensions; over a wide range of pressures and in particular at very low pressures; and with varied chamber geometries. Author (TAB)

N70-31470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BLADE MACHINES AND JET EQUIPMENT: SELECTED ARTICLES
V. S. Baikov et al 4 Feb. 1970 57 p refs Transl. into ENGLISH from Sb. Statei, Lopatochnyye Mashiny i Struynyye App. (USSR), no. 3, 1968 p 147-198
(AD-704050; FTD-MT-24-382-69) Avail: CFSTI CSCL 20/4

Contents: Investigation of a gas ejector with a multi-barrel supersonic nozzle of high-pressure gas; and Investigation of flow in the initial section of a sonic ejector in a short mixing chamber. TAB

N70-31583# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
NUMERICAL COMPUTATION OF THE SHOCK WAVE DIFFRACTED BY A CIRCULAR CYLINDRICAL CAVITY IN ELASTIC-PLASTIC MEDIA
Yoshisuke Nakano Jan. 1970 29 p refs
(AD-702906; CRREL-RR-279) Avail: CFSTI CSCL 13/13

A finite difference method for predicting the effect of shock waves on a circular cylindrical cavity in elastic-plastic media was studied. A two-dimensional Lagrangian code was found quite satisfactory. Attenuation of the shock waves through the cavity and the deformation of the cavity wall were discussed. Author (TAB)

N70-31594# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF LOW OSCILLATIONS IN A CLOSED LOOP WITH TRANSPARENT, PARALLEL, VERTICAL, HEATED CHANNELS Final Summary Report, 1 Feb. 1965 - 31 Dec. 1969
A. E. Bergles 1 Mar. 1970 8 p refs
(Contract Nonr-3963(15))
(AD-703644) Avail: CFSTI CSCL 20/4

The objectives of the program were to (a) obtain detailed experimental information on the stability behavior of a low pressure parallel channel system, and (b) to conduct analyses which would aid in generalizing this information and predicting stability thresholds for other fluids and operating conditions. Author (TAB)

N70-31634*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF LAMINAR BOUNDARY LAYER-SHOCK WAVE INTERACTION ON COOLED WALLS BY THE METHOD OF INTEGRAL RELATIONS
Frederick K. Goodwin, Jack N. Nielsen, and Larry L. Lynes 25 Jul. 1967 74 p refs
(Contract NAS2-4216; NEAR Proj. 116/C)
(NASA-CR-73461; NEAR-TR-2) Avail: CFSTI CSCL 20D

A complete description is given of the mathematical analysis of the problem. This analysis is based on the method of integral relations and extended to the highly-cooled wall case. It is noteworthy that a criterion was developed to determine the unique solution to the interaction problem for a given case. Based on the analysis, a computer program was developed to perform the calculations. A complete description of the input requirements of the program is included. A form to be used for preparing input data is included. Comparisons are made between calculated pressure distributions, velocity profiles, and skin-friction coefficients and those obtained experimentally. Author

N70-31653# Lockheed Missiles and Space Co., Palo Alto.
SUPERSONIC GAS FLOW AROUND A CONE AT AN ANGLE OF ATTACK
M. M. Vasilev [1970] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Mekhan. Zhidk. i Gaza (USSR), No. 1, 1970 p 33-39
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A solution is obtained for the problem of supersonic flow around an infinite circular cone taking account of terms O(E squared), where E is the ratio of the angle of attack to the cone half-angle. In contrast to the known Stone solution, higher order infinitesimal terms than the main terms are retained in the entropy conservation equation, which permits assurance of the correct behavior of the entropy and some associated functions in the whole stream, including the vortex layer. Results of numerical computations are compared with the Stone solution and a solution by the mesh method. Author

N70-31697# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
FORMATION AND PROPAGATION MECHANISMS OF DIVERGING GASEOUS DETONATION WAVES Final Scientific Report, Mar. 1967 - Mar. 1969

John H. Lee, Romas Knystautas, and Glen G. Bach Nov. 1969 17 p refs
(Grant AF-AFOSR-1290-67)
(AD-704158; MERL-69-12; AFOSR-69-3092TR) Avail: CFSTI CSCL 19/4

An experimental and theoretical program was carried out to study the formation and propagation mechanisms of diverging gaseous detonation waves. In essence the problem under study is representative of a more general and fundamental problem in the field of reactive gas dynamics and in flows with stagnation temperatures namely that of non-linear coupling between the gas dynamics and chemical kinetics in a transient flow field. In our case this was done by choosing a well-known hydrodynamic transient flow field that could be described by simple analytical methods and readily generated experimentaliy. The specific example chosen was the transient flow structure of a point initiated spherical blast wave propagating into a gaseous detonative medium. Theoretically, the so-called reacting blast wave; model has been developed and two limiting solutions have been obtained for this model using a novel analytical technique. Experimental simulation of the reacting blast wave model was achieved by laser spark ignition of an entire range of spherical reacting fronts. In this manner categorization of spherical reacting fronts into distinct regimes of propagation has become possible. Author (TAB)

N70-31797*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TURBULENT-BOUNDARY-LAYER HEAT-TRANSFER AND TRANSITION MEASUREMENTS WITH SURFACE COOLING AT MACH 6
Aubrey M. Cary, Jr. Washington Jun. 1970 50 p refs
(NASA-TN-D-5863; L-6825) Avail: CFSTI CSCL 20D

The effect of wall cooling on turbulent heat transfer and boundary layer transition for a sharp-leading-edge flat plate at Mach 6 and Reynolds numbers as high as 10 to the 7th power is investigated in a hypersonic wind tunnel. Decreasing the ratio of wall temperature to total temperature had little effect on the turbulent heat transfer coefficient. The Spalding and Chi method best predicted both the level and trend of the heat transfer data with wall cooling for the virtual origin located at peak heating and using the modified Karman Reynolds analogy. The transition Reynolds number increased from 30 to 60 percent when the ratio of wall temperature to total temperature decreased, but no transition reversal occurred. Author

N70-31805*# Lockheed Missiles and Space Co., Huntsville, Ala.
BASE RECIRCULATION FLOW PREDICTION USING A TIME-DEPENDENT FINITE-DIFFERENCE TECHNIQUE Final Report
William R. Waldrop May 1970 34 p refs
(Contract NAS8-30154)
(NASA-CR-102766; LMSC/HREC-D162322; HREC-0154-1) Avail: CFSTI CSCL 20D

Problems associated with computing the three-dimensional base recirculation flow of a perfect gas from multiple-clustered nozzles are discussed. A Lax-Wendroff time-dependent, finite-difference numerical scheme is presented as the most desirable technique for computing this flow field. Results of a preliminary investigation indicated that including viscous terms in this analysis was impractical because of the number of grid points required for accurate resolution within strong viscous regions. A cylindrical coordinate system with the axis at the center of the nozzle cluster simplified the specification of some boundary conditions, but extrapolation was required to specify conditions downstream of the nozzles and around the exterior of the nozzle wall. Stretching transformations are presented which concentrate grid points in the regions of the plume interaction. A possible modification to the numerical scheme which would permit using a steady form of the energy equation and, hence, reduce computer storage requirements is discussed. Stability of the numerical technique used in this study is also analyzed. Two techniques are presented for controlling the time step to ensure stability during the computation. Author

N70-31807*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDY OF GROOVE PATTERNS ON ABLATED SURFACES IN THE LANGLEY 8-FOOT HIGH-TEMPERATURE STRUCTURES TUNNEL
L. Roane Hunt and W. E. Bruce, Jr. Washington Jun. 1970 57 p refs
(NASA-TM-X-2030; L-6979) Avail: CFSTI CSCL 20D

An investigation was made in an 8-foot high-temperature structures tunnel to study the formation of ablation patterns on teflon surfaces of large cone and wedge models and on wood and Lexan surfaces of wedge models immersed in a high-enthalpy hypersonic stream. The tests were conducted at a Mach number of 7.4, at total temperatures between 1810 K and 1970 K, and at stream unit Reynolds numbers between 0.35 × 1,000,000 and 0.55 × 1,000,000 per meter. The results indicate that a turbulent boundary layer is necessary for the formation of groove patterns and that the local Mach number affects the groove angle. Also, a rearward-facing step in the turbulent boundary layer appears to cause the pattern to be more extensive. The patterns have a characteristic groove spacing, and they do not propagate laterally. Author

N70-31809*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF MULTIPLE-JET LIQUID INJECTION INTO HYPERSONIC FLOW
William F. Hinson, Paul B. Gooderum, and Dennis M. Bushnell Washington Jun. 1970 40 p refs
(NASA-TN-D-5861; L-6917) Avail: CFSTI CSCL 20D

Experimental data are presented for liquid injection through three inline orifices 0.051 cm in diameter. The liquid was injected from a flat plate at various downstream angles relative to the free-stream flow. Injection tests were made with different injection-angle combinations at various liquid and tunnel pressures. Free-stream Mach number, depending upon tunnel conditions, varied from 7.80 to 7.95. Some injection data were obtained with three formulations of a fluorocarbon liquid. The results indicate increased penetration when a jet is located in the wake of another jet. A decrease in penetration and in lateral spreading results when the injection angle is rotated downstream from a perpendicular to the surface. The limited data of the fluorocarbon liquid injection indicate that water penetrates farther than the fluorocarbons at the same test conditions. Author

N70-31818*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STAGNATION-POINT SOLUTIONS FOR INVISCID RADIATING SHOCK LAYERS
Walter B. Olstad Washington Jun. 1970 181 p refs
(NASA-TN-D-5792; L-5111) Avail: CFSTI CSCL 20D

Four approximate analytic solutions are presented which are valid in the following situations: (1) the effects of radiation can be treated as small perturbations; (2) the optical thickness of the shock layer is small; (3) the optical thickness of the shock layer is large; and (4) radiation is the principal mode of energy transport. The first two solutions include the effects of variable thermodynamic properties, variable and nongray optical properties, and body surface reflectivity. The third and fourth solutions are restricted to gray gases. The various solutions were used to indicate the effect of the radiation cooling parameter, the Bouguer number, the enthalpy dependence of the absorption coefficient, and surface reflectivity on the shock-layer enthalpy distribution, the stagnation-point radiant heat-transfer rate, and the shock standoff distance. A discussion

of the effect of radiation cooling on the stagnation-point convective heating rate is also included. The results indicate that at every altitude and velocity, there is a finite value of body nose radius for which the rate of radiant heat transfer is a maximum. Also a significant reduction in the computed value of the radiant heating results when the nongray character of the absorption coefficient is taken into account. Author

N70-31853*# Lockheed Missiles and Space Co., Palo Alto, Calif.
STAGNATION POINT ANALYSIS OF COUPLED VISCOUS-RADIATING FLOW WITH MASSIVE BLOWING
K. H. Wilson Washington NASA Jun. 1970 103 p refs
(Contract NAS7-632)
(NASA-CR-1548) Avail: CFSTI CSCL 20D

An analysis of the fully coupled viscous, radiating flow at the stagnation point of an ablating blunt body at hyperbolic entry conditions is presented. An exact numerical solution to the momentum equation has been developed which replaces the integral method approach employed in previous studies. This improved analysis yields an accurate solution to the conservation equations under conditions of massive blowing where the viscous transport layer is detached from the surface. The radiative transport model has been modified to obtain an accurate calculation of both continuum and line transport for arbitrary mixtures of H, C, N and O atoms. A comparison of our current results for the stagnation point surface radiative flux at hyperbolic velocities with recent results of a number of other investigators show that (for the case of a non-ablating surface), when all important radiating processes are accounted for, agreement to within about 20% exists. For the case of the blunt body heating problem with large surface mass injection (of predominantly hydrogencarbon ablation gases) the role of atomic line radiative transport in the ablation gases is clarified. Author

N70-31869*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
MEASUREMENT OF NON-CONTINUUM AND TURBULENCE EFFECTS ON SUBSONIC SPHERE DRAG
Neil A. Zarin Washington NASA Jun. 1970 137 p refs
(Grant NGR-23-005-003)
(NASA-CR-1585) Avail: CFSTI CSCL 20D

The drag of spheres, at Mach numbers from 0.10 to 0.57, Reynolds numbers ranging from 40 to 5000, Knudsen numbers as high as 0.060, and turbulence intensities up to 13% was measured in a continuous wind tunnel utilizing a magnetic suspension system. Stainless steel ball bearings having diameters of from 1 mm to 1/4 in. were used as models. The effects of free-stream turbulence, compressibility, and gas rarefaction were observed and compared with existing data wherever possible. Author

N70-31889# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TURBULENT BOUNDARY LAYER SEPARATION INDUCED BY THREE-DIMENSIONAL PROTUBERANCES
E. F. Lucero Jan. 1970 77 p refs
(Contract NOw-62-0604-C)
(AD-703240; APL-TG-1094) Avail: CFSTI CSCL 20/4

The report presents the results of an experimental investigation on the extent of separation of a turbulent boundary layer due to cylindrical protuberances, square prisms, and triangular prisms mounted on a flat plate. The effect of the separated flow on the pressure distribution along the centerline of the plate and on the surface of the attached protuberances is shown. The widths of the protuberances were 0.6 and 1.0 inch, and the ratio of protuberance height to boundary-layer thickness, h/sigma, ranged from 0.3 to 4.4. The test Mach number was 2.17, and the unit Reynolds number was 3,000,000/ft. Results from the experiment indicate that: (1) when h/sigma, the extend of separation is dependent on protuberance height and on the diameter of the cylinder or the breadth of the square prism, but when h/sigma < or = 0.6 or when a triangular prism is used, no separation occurs; (2) the root pressure coefficient exceeds the plateau pressure coefficient by as much as 33% in the cases where the boundary layer does not separate; (3) a linear correlation exists between the initial-pressure-rise distance and the protuberance height; and (4) the cylinder stagnation pressures do not show a significant dependence on cylinder height for h/sigma < or = 1.80. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-30632*# Translation Consultants, Ltd., Arlington, Va.
PROBLEMS OF CONSTRUCTING A COORDINATE SYSTEM REFERRED TO THE EARTH'S CENTER OF MASS AND AXIS OF ROTATION [VOPROSY POSTROENIYA SISTEMY KOORDINAT, OTNESENNOY K TSENTRU MASS I OSI VRASHCHENIYA ZEMLI]
A. A. Izotov Washington NASA Jun. 1970 14 p refs Transl. into ENGLISH from Geod. i Kartografiya (USSR), v. 14, no. 9, 1969 p 12–19
(Contract NASw-2038)
(NASA-TT-F-13005) Avail: CFSTI CSCL 08E

A description is given of several possible ways for constructing a coordinate system referred to the earth's center of mass and axis of rotation, using results of artificial satellite observations. Problems involved in determining the relative orientation of astronomical and geodesic grids are reviewed, and possible solutions are evaluated. It is shown that the position of the origin of a geodesic coordinate system relative to the earth's center of mass can be determined on the basis of purely geometrical concepts and methods. Author

N70-30635# Bergen Univ. (Norway). Seismological Observatory.
SEISMIC NOISE STRUCTURE AT THE NORWEGIAN SEISMIC ARRAY
Hilmar Bungum, Leif Bruland, and Eivind Rygg 1 Dec. 1969 46 p refs
(Contract F61052-68-C-0019)
(AD-702825; SR-4; AFOSR-70-0525-TR) Avail: CFSTI CSCL 8/11

Power spectral analysis in frequency-wavenumber space and coherence studies in lag space have shown that the noise recorded by the short period 12 sensor subarray at NORSAR is critically dependent on the weather situation in the North Atlantic Ocean. In addition to the low frequency noise from the west, there is observed 2 second microseisms from the Baltic Sea. Because of the non-isotropic noise, the coherence is usually strongly azimuthal dependent, being represented in lag space by ellipses. Time variations of the coherence by a factor of 5 are easily observed. TAB

N70-30664# Army Engineer Topographic Labs., Fort Belvoir, Va.
SATELLITE GEODESY BASED ON STELLAR ORIENTATION OF LINES BETWEEN UNKNOWN STATIONS
Angel A. Baldini Nov. 1969 55 p refs
(AD-702921; USAETL-RN-3216) Avail: CFSTI CSCL 8/5

The research note represents one step of the theory for the problem of determining the ground station positioning with respect to the center of earths mass, the world geocentric geodetic system, and the mathematical figure of the earth. The theory is

based solely on optical observations of any type of satellite and, therefore, is independent of any distance measurement. In the research note, formulations are given for determining the orientation of lines with respect to the mean equator and mean equinox for a given epoch. The station-to-satellite directions resulting from photographs are used for making the orientation of lines between unknown stations. From among lines so oriented, the astronomic azimuth and zenith distance between nonintervisible stations can be computed, and intercontinental astronomic azimuth ties can be achieved. Author (TAB)

N70-30665# Army Engineer Topographic Labs., Fort Belvoir, Va.
A NEW SOLUTION FOR THE ANOMALOUS GRAVITY POTENTIAL RESULTING FROM A MODIFICATION OF MOLODENSKY'S LINEAR APPROXIMATION, ITS PRACTICAL SIGNIFICANCE, AND NUMEROUS RAMIFICATIONS
Hans Baussus-Von Luetzow Jan. 1970 31 p refs
(AD-702922; USAETL-RN-33) Avail: CFSTI CSCL 8/5

The research note is concerned with the symbiosis of classical and modern theory of gravimetric geodesy. The formulas obtained are essentially equivalent to those of Molodensky and Brovar but are less data dependent, more direct from the computational point of view, and more advantageous pertaining to the utilization of artificial earths satellite data. Due to the inclusion of terms involving a non-vanishing topographic mean density, the new theory is more general than the method of Bjerhammar and, therefore, not dependent on a least-square solution subject to a growing bias with decreasing wave length. It also has ramifications regarding simplified models and model combinations derived or proposed by other authors. Author (TAB)

N70-30678# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 228 13 May 1970 p 23-31 (See N70-30675 16-34)
Avail: CFSTI

Summaries are reported on the genealogy of the ocean, scientific cruises of Soviet research vessels, the indicatrix of scattering for light in sea water, the emissivity and reflectivity of ice in the infrared spectrum, the anisotropy of radio wave attenuation in sea ice, the transport and transformation of turbulent energy in the ocean, statistical analysis of wind velocity measurements in the near-water layer, long waves in an inhomogeneous viscous fluid, the theory of the active layer in the open ocean, and ice navigation conditions in Antarctic waters. R.B.

N70-30679# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 228 13 May 1970 p 32-50 (See N70-30675 16-34)
Avail: CFSTI

Descriptions are given of aerial surveys from aircraft and satellites, a radio controlled seismograph with magnetic recording, electrochemical seismic detectors, exchange waves to study seismicity beneath Alma-Ata, a quartz astatic element, isotope geochronology and deep crustal structure, geological interpretation of magnetic measurements in Antarctica, discriminating regional background in interpreting gravity and magnetic anomalies, determining absorption of explosive waves in the ground from records of stresses and strains, use of a radio range finder in marine geophysical work, geodetic programs for Minsk-2 electronic computer, discontinuities in upper crust, the mechanism of volcanic earthquakes, generation of microseisms in Sea of Akhotsk, horizontal inhomogeneities in earth interior, and earthquake prediction by hydrogeological methods. R.B.

N70-30680# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 228 13 May 1970 p 51-78 (See N70-30675 16-34)
Avail: CFSTI

Summaries are presented on an encyclopedia of cosmonautics, aspects of Soviet thought on the space program, orbital space stations, launching of Cosmos satellites, records for group flight of Soyuz spacecraft, Orbita television receiving stations, space transport vehicles, global photography of the earth, meteorological satellites and the weather service, oceanography from space, drift of ionospheric inhomogeneities, variation in atmospheric parameters during magnetic storms, rate of ion formation in F2 layer, lower ionosphere effect on radio wave reflections from E layer, relationship between magnetic field and sporadic E layer, Soviet hydrometeorological investigations in Antarctica, establishment of Arctic drifting station, and development of thermal coveralls. R.B.

N70-30852*# Aztec School of Languages, Inc., Maynard, Mass.
PROBLEMS OF ATMOSPHERIC PHYSICS: COLLECTION 5
K. Ya. Kondratyev, ed. Washington NASA Jun. 1970 269 p Transl. into ENGLISH of the publ. 'Problemy Fiziki Atmosfery: Sbornik 5' Leningrad, Leningrad State Univ. Press, 1967 p 3-261
(Contract NASw-1692)
(NASA-TT-F-587) Avail: CFSTI CSCL 04A

This collection contains the studies of the faculty of atmospheric physics of Leningrad State University on the thermal regime of the troposphere, stratosphere, and mesosphere; the problems of atmospheric optics and spectroscopy; and the microphysics of clouds. For individual titles, see N70-30853 through N70-30876.

N70-30853*# Aztec School of Languages, Inc., Maynard, Mass.
AN ANALYSIS OF THE COUNTERRADIATION SPECTRA OF THE ATMOSPHERE
S. V. Ashcheulov et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 1-8 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The counterradiation spectra of the atmosphere according to the data of experiments at Kaunas in the summer of 1965 under the most diversified meteorological conditions and according to the data of other recent studies is analyzed. A comparison is made of these data and those of theoretical calculations. Author

N70-30854*# Aztec School of Languages, Inc., Maynard, Mass.
A DETERMINATION OF THE ABSORPTION COEFFICIENTS FOR CERTAIN ATMOSPHERIC WINDOWS AND ABSORPTION BANDS ACCORDING TO EMISSION SPECTRA
S. V. Ashcheulov et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 8-12 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

Absorption coefficients are determined for certain atmospheric windows and absorption bands according to emission spectra obtained at Kaunas in the summer of 1965 and according to data from other studies. The absorption coefficients in some secondary bands are described well by an exponential function. Author

N70-30857*# Aztec School of Languages, Inc., Maynard, Mass.
THE THERMAL EFFECT OF RADIATION AND THE FACTORS DETERMINING IT IN THE ATMOSPHERIC LAYER FROM 30 TO 100 km: REVIEW
G. M. Shved *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 23-61 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The basic points of information on the role of radiation in the thermal regime of the layer of 300-100 km are reviewed. The basic difficulties encountered in solving the problem are also

noted. The relationship of this problem to the intensity of solar radiation, the composition of the atmosphere, the temperature and its variations, the absorption functions and the fluorescence processes is discussed. Author

N70-30858*# Aztec School of Languages, Inc., Maynard, Mass.
TRANSMISSION FUNCTIONS OF THE REAL ATMOSPHERE
Yu. M. Timofeyev *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 62–68 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

After discussing the various methods of calculating the transmission functions of the real atmosphere, it is concluded that the method of considering the nonuniformity of the atmosphere in approximation gives the greatest errors for the atmospheric stratifications where an increase in the mixing ratio of the absorbing gas is observed with a decrease in the pressure. The Curtis–Godson method is found to be unsuitable for certain types of equations and conditions, as is the effective-mass method. Author

N70-30860*# Aztec School of Languages, Inc., Maynard, Mass.
A METHOD OF CALCULATING THE SPECTRAL ABSORPTION OF INFRARED RADIATION IN THE ATMOSPHERE
A. G. Pokrovskiy *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 85–109 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

A method is developed for calculating atmospheric spectra of water vapor absorption for arbitrary distributions of concentration, temperature and atmospheric pressure, with a consideration of the line broadening due to the Doppler effect. It is shown how this method will be useful in solving many atmospheric problems in which a precise value must be given for the absorption function. Author

N70-30861*# Aztec School of Languages, Inc., Maynard, Mass.
INVESTIGATION OF THE 9.6 MICRONS ABSORPTION BAND OF OZONE IN THE ARTIFICIAL ATMOSPHERE
A. P. Galtsev *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 110–126 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

After studying the 9.6 microns absorption band of ozone in the artificial atmosphere, it was found that the data must be made more accurate (values for the ozone content were roughly 5% lower than those presented), an equation is derived to describe experimental results. Author

N70-30885*# Aztec School of Languages, Inc., Maynard, Mass.
RADIATION BALANCE AND ITS COMPONENTS IN THE TROPOSPHERE AND STRATOSPHERE ACCORDING TO ASCENTS OF AIRSHIPS IN THE AUTUMN IN 1964–1965
K. Ya. Kondratyev et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 159–167 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The radiation balance and its components in the troposphere and stratosphere are discussed on the basis of data from actinometric airship soundings in the autumn in 1964 and 1965. It is suggested that, particularly in the cases under investigation, a volcanic eruption and an increase in meteors could bring about an anomalous decrease of direct solar radiation. Author

N70-30869*# Aztec School of Languages, Inc., Maynard, Mass.
HYDROGEN COMPOUNDS IN THE MESOSPHERE
V. N. Konashenok *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 200–206 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The different reasons for studying the hydrogen compounds in the mesosphere are discussed along with a description of a relative simple method of measuring the H2O and OH emission profiles. Author

N70-30872*# Aztec School of Languages, Inc., Maynard, Mass.
THE SELECTIVITY OF AEROSOL ATTENUATION IN OZONOMETRIC OBSERVATIONS OVER ZAILIYSKIY ALA TAU
A. L. Osherovich et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 224–240 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

This article is an attempt at solving the problem of considering aerosol extinction in ozonometric observations. After a discussion of such measurements at three geographic sites around Alma Ata at different sea levels, it is shown that narrow light filters and instruments of the same type should be used to compare the data obtained. Author

N70-30925*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
MULTISPECTRAL DATA ANALYSIS Final Report
David S. Hanson and David R. Morganstein May 1970 129 p (Contract NAS12-2123)
(NASA-CR-86409; BSR-2941) Avail: CFSTI CSCL 08H

Contour maps and prediction lines demonstrate the existence of water depth information in multispectral data, and further, that this information is recoverable. The technique of linear regression analysis proved to the most useful tool applied to the information extraction problem. The physical parameters were studied and a mathematical model derived which suggests an exponential relation between reflectance and depth, thus posing initial restrictions on linear processing techniques. Measurable reflectance changes were shown to be asymptotic to a common value dependent only on scattering and absorption properties of the water. Multispectral data would not contain depth information beyond that value. Both time series and factor analysis were used to assist in the association of a depth measure with a set of reflectances, the latter being discussed in detail. E.M.C.

N70-30934# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
THE ADJUSTMENT OF AN ASTROGEODETIC NET MODEL [URAVNIVANIE MODELI ASTRONOMO-GEODEZICHESKOI SETI]
M. I. Yurkina et al Nov. 1969 25 p Transl. into ENGLISH from Tr. Tsentr. Nauchn.-Issled. Inst. Geodezii, Aeros'yemki i Kartografii (Moscow), no. 176, 1969 p 68–87
(AD-700904; ACIC-TC-1585) Avail: CFSTI CSCL 8/5

The method of adjusting an astrogeodetic net model is illustrated on a model net. The computation results are tabulated and the overall total is given. Author (TAB)

N70-30992*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
STUDIES OF AURORAE AND UPPER ATMOSPHERE BY RADIOPHYSICAL METHODS
Ye. A. Ponomarev et al Washington NASA Jun. 1970 98 p refs Transl. into ENGLISH of the publ. 'Issledovaniye Polyarnykh Siyaniy i Verkhney Atmosfery Radiofizicheskimi Metodami' Moscow, Nauka Press, 1967 p 7–81 IGY Ser. No. 15
(Contract NASw-1692)
(NASA-TT-F-618) Avail: CFSTI CSCL 04A

The results of a study of sporadic ionization zones associated with aurora and ultralow frequency radio emission in the auroral zone are presented. On the basis of parameters calculated according to a physical model, the study of conditions of origination of diffusion quasineutral waves in the auroral plasma is carried out. These

waves are assumed to cause the diffusion of the ultrashort wave signals. The radar equipment is described which was used to observe radio reflections from the zones of sporadic ionization in 1964 – 1965 in Yakutsk. The equipment which carried out observations of continuous ultrashort emission in 1962 – 1965 in the Tiksi Bay region is also described. Author

N70-31031# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

THE PROBLEM OF ALLOWING FOR THE EFFECT OF THE CENTRAL ZONE ON THE VALUE OF MOLODENSKIY'S CORRECTION G SUB 1 [K VOPROSU OB UCHETE VLIYANIYA TSENTRALNOI ZONY NA VELICHINU POPRAVOK G1 MOLODENSKOGO]

M. I. Yurkina et al Dec. 1969 7 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn.-Issled. Inst. Geodezii, Aeros'yemki i Kartografii (Moscow), no. 176, 1969 p 88 – 97

(AD-700905; ACIC-TC-1586) Avail: CFSTI CSCL 8/5

The paper considers the problem of allowing for the effect of the central zone on the value of Molodenskiys correction G sub 1 to the gravity anomaly delta g. The value of the correction may be unstable when the radius L of that zone is varied. In the general case, the elevation of the integration surface should be represented in its separate parts as a function of the plane coordinates, permitting the calculation of second derivatives. TAB

N70-31035# Ballistic Research Labs., Aberdeen Proving Ground, Md. Signature and Propagation Lab.

ELECTRON CONTENT OF BARIUM PLASMAS IN THE HIGH ATMOSPHERE

Raymond E. Prenatt, William A. Dean, and Warren W. Berning (DASA) Dec. 1969 50 p refs

(AD-700960; BRL-1459) Avail: CFSTI CSCL 4/1

At evening twilight on 4 October 1967 a rocket carrier released three barium clouds off Wallops Island, Virginia. The vehicle also carried a multifrequency VHF beacon for the observation of radio frequency dispersive phase and amplitude variations in signals propagated through the release clouds, and as a derived quantity, total electron content along the propagation paths. The first cloud, at 103 kilometers, introduced no measurable dispersive phase variations and only a brief decrease in signal strength. The other clouds at 187 and 226 kilometers produced large and unusual effects on both dispersive phase and signal strength data. Analysis of the dispersive phase data obtained during rocket descent, when the rocket had emerged from behind the release clouds, yielded a normal electron density profile. A preliminary attempt at interpreting the data relevant to the second release employed ray tracing through spherically symmetric, diffusing cloud models with a gaussian electron density distribution. By varying the parameters defining the cloud, a model was devised that closely duplicated both the dispersive phase and signal strength data. Author (TAB)

N70-31045# Atomspheric Sciences Lab., White Sands Missile Range, N.Mex.

AN EVALUATION OF INFLATABLE FALLING SPHERE DENSITY DATA

Robert Olsen Dec. 1969 41 p refs

(AD-700951; ECOM-5287) Avail: CFSTI CSCL 4/1

Density measurements utilizing inflatable passive falling spheres were made at White Sands Missile Range. Two different rocket vehicle systems, the Viper Balloon dart system and the Super Loki balloon dart system, were used to deploy the sphere at apogee to demonstrate the capabilities of each of these systems in providing high-altitude data. Five sets of density data computed from a total of fourteen flights were compared with density data derived from rocketsonde soundings and the 1966 Standard Atmosphere. A negative density departure from the 1966 Standard Atmosphere was shown to exist between 70 and 80 km. Two sets of density data were derived from each flight, with the exception of the first flight, one utilizing the Sandia drag table, the other the University of Minnesota drag table. The difference between the density values using the two tables can be as great as 12%. Density data computed from these flights were compared with density data derived from rocketsonde soundings and the 1966 Standard Atmosphere. Author (TAB)

N70-31197# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THE 1969 SMITHSONIAN STANDARD EARTH (II)

E. M. Gaposchkin and K. Lambeck 18 May 1970 104 p refs

(SAO-Spec-Rept-315) Avail: Issuing Activity

Geodetic parameters describing the earth's gravity field and the positions of satellite tracking stations in a geocentric reference frame were computed. These parameters were estimated by means of a combination of four different types of data: routine and simultaneous satellite observations, observations of deep space probes, and measurements of terrestrial gravity. This combination solution gave better parameters than any subset of data types. In the dynamic solution, precision reduced Baker – Nunn observations and laser range data of 21 satellites were used. Data from the tracking of deep-space probes were used in the form of relative station longitudes and distances to the earth's axis of rotation. In addition to these four data sets, astrogeodetic data, surface triangulation, and some recently acquired surface gravity data not included in the set used for the combinations were employed for an independent test of the solution. The total gravity field is represented by spherical harmonic coefficients complete to degree and order 16, plus a number of higher degree terms. The accuracy of the global field has been estimated as + or – 3 m in geoid height or + or – 8.7 mgal. Author

N70-31216# Los Alamos Scientific Lab., N.Mex.

RESONANCE RADIATION IN ARTIFICIAL STRONTIUM AND BARIUM CLOUDS

Henry G. Horak, Donald M. Kerr, and Martin S. Tierney 31 Dec. 1969 26 p refs

(Contract W-7405-eng-36)

(LA-4313) Avail: CFSTI

The problem of the resonance scattering of sunlight by a spherically symmetric, optically thick gas cloud is considered. Theoretical isophotes, line profiles, and irradiances are computed by using a two-level atomic model, but the multiple scattering is taken rigorously into account. The assumptions are as follows: (1) the cloud possesses spherical symmetry insofar as particle space-density is concerned, (2) only resonance scattering of sunlight is considered, (3) radiative equilibrium exists, (4) the cloud is isothermal with a kinetic temperature given by the ambient air temperature, (5) the absorption coefficient of the gas is determined by the Doppler effect, (6) the scattering phase-function is spherical, (7) the hypothesis is made of complete frequency redistribution (the frequency of the emitted quantum is randomly related to the frequency of the absorbed quantum), and (8) collisional excitation and deexcitation are ignored. These assumptions enable the formulation of an integral equation for the number density of excited atoms at the point r. This integral equation is solved by iteration, after which it is possible to find the complete intensity field by direction integration. Line profiles and line strengths for the emergent radiation can then be readily calculated. Author (NSA)

N70-31322# Massachusetts Inst. of Tech., Cambridge.

ATMOSPHERIC GRAVITY WAVE STUDIES, PART A Final Report

Theodore R. Madden, Roger J. Breeding, Terry Aldon, Jon F. Claerbout, and Stephen P. Miller Mar. 1970 17 p refs

(Contract DA-31-124-ARO(D)-431)

(AD-703927; AROD-6086-2-EN) Avail: CFSTI CSCL 4/1

The linear theory of atmospheric gravity waves in a windy atmosphere and in the presence of a conducting ionosphere are developed. These results are applied to ground level observations of pressure fluctuations and it is shown that much of the background pressure fluctuations is due to instabilities of the tropospheric jet stream. A nonlinear study of these waves shows how the waves and wind interact. These interactions can change the jet stream profile and develop turbulence, but the theory of all these effects is still incomplete. Author (TAB)

N70-31335# Air Force Cambridge Research Labs., Bedford, Mass.
EARTH SCIENCE APPLIED TO MILITARY USE OF NATURAL TERRAIN
Stanley M. Needleman and C. E. Molineux Aug. 1969 212 p refs *Its* AF Surv. in Geophys. No. 211
(AD-704140; AFCRL-69-0364) Avail: CFSTI CSCL 8/2

A survey of the state-of-the-art in the evaluation of natural terrain by earth-science techniques and measurement systems is presented in response to a need that existed for many years. This report considers the terrain as an envelope of the environment and all related parameters that are basic in an evaluation for relevant military applications such as unimproved landing areas, trafficability, site selection for operational facilities, terrain reconnaissance and surveillance, and target detection within a masked terrain complex. Methods of terrain-data acquisition, analysis, and evaluation and their limitations are reviewed. The status of research and development, specifying the gaps in technology, is summarized with accompanying conclusions. The report forecasts the requirement for an automated terrain-data acquisition, storage, and display system. Information pertaining to the classification of terrain data, field devices to measure bearing strength, and a visualized optimum remote sensing system is also given in the appendix. A glossary and a comprehensive bibliography are included. Author (TAB)

N70-31343# Texas Univ., Austin. Center for Research in Water Resources.
RADIOACTIVITY TRANSPORT IN WATER: MATHEMATICAL SIMULATION
Allen White and Earnest F. Gloyna [1969] 37 p refs
(Contract AT(11-1)-490)
(ORO-490-19; EHE-70-4; CRWR-52; TR-19) Avail: CFSTI

A mathematical model has been developed for routing a radionuclide through a model river system. The capabilities of this simulation model include the following characteristics: it distributes radionuclide activity by advective and dispersional mechanisms along the longitudinal axis of the system; it may be discretized into any number of segments (vertical planes normal to the longitudinal axis) as may be appropriate to describe spatial variations in radionuclide activity; it is capable of treating instantaneous, continuous, or time-varying releases of radionuclide activity; it provides for a temporal description of radionuclide activity throughout the system; and it provides for sorption and desorption by both plants and bottom sediments. Author (NSA)

N70-31379# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
OCEANIC TELESCOPE ENGINEERING PROGRAM: REPORT ON PILOT PROJECT INSTALLATION, PERFORMANCE, RECOVERY, EVALUATION, AND PROGRESS THROUGH DECEMBER 1969
John M. Dahlen Mar. 1970 169 p refs
(Contract Nonr-3963(31))
(AD-704114; E-2367) Avail: CFSTI CSCL 8/10

The Oceanic Telescope is an instrument system designed to observe internal waves in the main thermocline off Bermuda. An earlier report described the design of the telescope and the testing programs accomplished prior to its successful installation in the ocean. This report describes the ocean installation, operational performance, recovery, and final evaluation of the system and its components from an engineering point of view. The essence of the system is a taut tri-moor, one leg of which is horizontal and two miles long at 630 meters depth. The array of sensors on this leg possesses a one-dimensional antenna property designed to observe waves of period greater than 15 minutes and half-amplitude greater than 10 meters. The system installed was a pilot project having the dual objective of: (1) contributing to ocean science and technology, and (2) providing the basis for design of an advanced experiment. These objectives were met without qualification. Long periods of unique data were obtained, which provide new insights into the nature of internal waves deep in the ocean. Author (TAB)

N70-31402# European Space Research Inst., Frascati (Italy).
NONLINEAR EVOLUTION OF THE TEARING INSTABILITY IN THE GEOMAGNETIC TAIL
D. Biskamp, R. Z. Sagdeev (Inst. of Nucl. Phys., Novosibirsk, USSR), and K. Schindler Mar. 1970 23 p refs
(ESRIN-IN-78) Avail: CFSTI

The nonlinear evolution of the tearing instability is considered in the framework of quasi-linear theory. It is shown that quasi-linear diffusion will lead to a velocity anisotropy which stabilises the tearing instability at a very small level of the tearing turbulence. The corresponding anisotropy is too small to drive the Fried-Weibel mode. The effect of an equilibrium magnetic field component transverse to the sheet and the dynamics of single modes are discussed qualitatively. It is concluded that the tearing instability can lead to small scale turbulence in the neutral sheet; nonlinear effects however will prevent the sheet from undergoing gross destruction. This is consistent with observations in the geomagnetic tail. Author (ESRO)

N70-31473# Ohio State Univ., Columbus. Dept. of Geodetic Science.
NONLINEAR SOLUTIONS OF THE GEODETIC BOUNDARY-VALUE PROBLEM
Helmut Moritz Oct. 1969 65 p refs
(Contract F19628-69-C-0127)
(AD-702859; Rept-126; AFCRL-69-0528; SR-2) Avail: CFSTI CSCL 8/5

A complete series solution of Molodenskys boundary value problem is derived using, instead of an integral equation, analytical continuation by means of power series. This solution is shown to be equivalent, term by term, to the Molodensky-Brovar series, but is simpler and practically more convenient. This equivalence gives a physical explanation of the divergence of the Molodensky series. The exclusion of topographic masses to improve convergence is discussed, and computational formulas for height anomalies and deflections of the vertical are given. In the Appendix, structural similarities between the series of celestial mechanics and of physical geodesy are used to get an insight into the convergence behavior of these series. Another argument for the divergence of series of Molodensky type is given. Author (TAB)

N70-31534# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
ATTENUATION AND EMISSION OF THE ATMOSPHERE AT 3.3 mm, DECEMBER 1963–AUGUST 1969
F.I. Shimabukuro and E.E. Epstein 31 Dec. 1969 28 p refs
(Contract F04701-69-C-0066)
(AD-703708; TR-0066(5230-48)-2; SAMSO-TR-70-77) Avail: CFSTI CSCL 3/2

Four empirical relationships are presented between the 3.3-mm attenuation determined from observations of the sun and (1) radiosonde measurements of the total amount of precipitable water in the atmosphere, (2) surface measurements of absolute humidity,

(3) IR spectral hygrometer observations of the sun, and (4) observations of differential atmospheric emission at 3.3 mm. Fluctuations in atmospheric emission at 3.3 mm during good weather do not put any limit on the sensitivity of a dual-beam observing system using a receiver whose rms noise fluctuations in an output noise bandwidth of 0.25 Hz are nearly equal to 0.5K. Author (TAB)

N70-31557# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF A THREE-AXIS LONG-PERIOD SEISMOGRAPH Final Report, 1 Jun. 1967 – 31 Dec. 1969
Ivan Simon 16 Feb. 1970 86 p refs
(Contract F44620-67-C-0107; ARPA Order-1029)
(AD-702794; ADL-C-69429; AFOSR-70-0526TR) Avail: CFSTI CSCL 12/1

Three-axis, long-period, compact (borehole) seismometer system utilizing feedback-controlled seismic transducers based on magnetic suspension principle was developed, constructed and tested. The system includes digital tape recording and data processing. The overall system response is flat to 3db over a pass band from .02 to .07 Hz and the dynamic range is 60db. Results of tests show that surface waves from teleseismic events of m sub b less than or equal to 5 are consistently recorded. Horizontal components of surface waves from earthquakes in the Gulf of California region have been observed at the Ogdensburg, New Jersey test site. Author (TAB)

N70-31584# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ATTENUATION OF VISIBLE LIGHT BY FALLING SNOW
Harold W. O'Brien Jan. 1969 33 p refs
(AD-702905; CRREL-RR-242) Avail: CFSTI CSCL 8/12

The attenuation of visible light by falling snow was studied by making simultaneous attenuation measurements and snow concentration measurements. The attenuation coefficient was calculated from photometric measurements and from visual observations. Snow concentration in the air was evaluated by two methods: from Formvar replicas collected during the snowfall, and by mass accumulation of snow in collecting pans. The snowflakes were arbitrarily classified by crystal types according to their estimated fall velocity. It was found that the correlation between extinction coefficient (attenuation) and snow concentration was generally much higher by types than when all snowflakes were considered together regardless of crystal components and degree of riming. Two types, apparently improperly classified, displayed lower correlations than the overall group. When no fog is present during the snowfall, the experimental results coincide well with attenuation theory if a reasonable correction is applied to the values obtained in the measurement of snowflake diameters. Measurements of mass flux indicate that for a given intensity the attenuation caused by snow is an order of magnitude greater than that caused by the same mass flux of rain. Author (TAB)

N70-31588# Alaska Univ., College. Geophysical Inst.
THE EFFECT OF BAROMETRIC PRESSURE VARIATION AND THE 'USO' LONG-PERIOD SEISMOMETER
Eduard Berg and Ronald Rasmussen Feb. 1970 31 p refs
(Contracts F44620-68-C-0066; F44620-70-C-0031; ARPA Order 292)
(AD-703753; AFOSR-70-0802TR) Avail: CFSTI CSCL 8/11

The particular manner of mechanical construction of the Long-Period U.S.O. package is responsible for the pressure sensitivity of the LP-X component. The effect seems to be linear with pressure for periods larger than the seismometer period and short compared to the feedback signal time constant. Since the pressure induced displacements are considered as very undesirable noise for the instrument as either long period seismometer or as tiltmeter the borehole was pressure sealed and the effect removed. Records are presented to demonstrate the effect. Author (TAB)

N70-31589# Alaska Univ., College. Geophysical Inst.
TECTONIC MOVEMENT, DEFORMATION RELEASE AND CRUSTAL STRUCTURE STUDIES IN ALASKA Final Report, 1968 – 1969
Eduard Berg Jan. 1970 67 p refs
(Contract F44620-68-C-0066; ARPA Order 292)
(AD-703748; AFOSR-70-0803TR) Avail: CFSTI CSCL 8/7

The seismic telemeter system data now cover a total of three years record for central Alaska. Monthly epicenter maps for the contract period are given. The tectonic pressure axis have been determined using earthquakes occurring in the network. Three borehole packages of the USO type have been installed in Gilmore, Paxson and McKinley. It was found that the construction of the long-period part of the borehole package makes the LP-X component a very sensitive microbarograph, covering the period range from 15 sec to DC. Tilts associated with local earthquakes of small magnitude at short distances are discussed. Laboratory results on brittle rock failure seem to be valid for the earth crust. If foreshocks occur at all, the b slope of the Gutenberg-Richter Relation, linking the log of the number to the magnitude of the earthquakes, seem to indicate high average stress levels for small areas and prior to a small main shock, the larger areas associated with relatively stronger earthquakes seem to be associated with lower average stress levels. Author (TAB)

N70-31609# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN INVESTIGATION INTO THE FEASIBILITY OF PROCESSING WAVE INTERACTION DATA IN DIGITAL FORM
C. L. Croskey 20 Mar. 1970 69 p refs
(Contract Nonr-656(35); Grant NSF GA-1456)
(AD-704094; SR-351) Avail: CFSTI CSCL 4/1

The wave interaction experiment at the Ionosphere Research Laboratory presently operates in analog form. Tuned filters and coherent detection are used to obtain the delta amplitude of returned radio pulses which have been disturbed by wave interaction in the ionosphere. An investigation was conducted concerning the feasibility of processing the wave interaction data in digital form. Various related instrumentation schemes are briefly considered. A system is proposed which obtains a digital number proportional to the average value of each returned radio pulse. This data is conveyed to a digital computer or arithmetic processor. Special computer programs called digital filters can then be used to analyze the data. A simple digital filter system is discussed. A guard section removes the strong DC component. Then the digital equivalent of coherent detection is performed. A lowpass output filter provides most of the S/N improvement. A prototype is described which was built to formalize some of the ideas about such a system. Author (TAB)

N70-31629# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
OPTICAL PROPERTIES OF SEA WATER OF THE NORTH ATLANTIC OCEAN AT ARGUS ISLAND AND BLOCK ISLAND SOUNDS AT LONG ISLAND
R. Morrison 17 Feb. 1970 86 p refs
(AD-703215; NADC-AE-6918) Avail: CFSTI CSCL 8/10

Attenuation, absorption, and scattering coefficients were obtained from nearly simultaneous optical measurements at sea. The total scattering coefficients were computed for 159 samples from data obtained with two scattering meters, one of which was capable of measuring the volume scattering function at 0.2 degrees. Depth profiles of the optical properties were compared for consistency, and overall agreement within a factor of two was observed. Consistent agreement between an increase in the turbidity and the top of the seasonal thermocline were demonstrated by data profiles from Argus Island. The light attenuation distributions at the coastal stations were influenced by the tidal cycle and fresh water run-off. Author (TAB)

N70-31691# Bochum Observatory (West Germany).
STUDIES OF THE IONOSPHERE USING TRANSMISSIONS FROM ACTIVE SYNCHRONOUS SATELLITES Final Scientific Report, 5 Apr. 1968 - 13 Jan. 1969
H. Kaminski and W. Rueskamp 13 Oct. 1969 60 p refs
(Contract F61052-68-C-0054)
(AD-703740; AFCRL-70-0203) Avail: CFSTI CSCL 4/1

The exploration of the ionosphere by means of classic methods, i.e., by reflection sounding from the earths surface or by balloon ascents has been essentially expanded after 1957 by using artificial satellites. Now, for the first time, satellites equipped with transmitters for ultrashort-waves and still higher frequencies were in orbit inside and outside the ionosphere. The investigation of the propagation characteristic of the various frequency ranges revealed several new evidences about the structure and the dynamics of the ionosphere/troposphere. The study investigates the influence of the earths atmosphere on the propagation of an ultrashort-wave (136 MHz), transmitted from a synchronous satellite keeping its position towards the receiving place practically unaltered. Author (TAB)

N70-31736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE LAWS GOVERNING THE VARIATION OF THE REFRACTIVE INDEX IN WINTER
D. I. Maslich et al 20 Jan. 1970 18 p refs Transl. into ENGLISH from Geod., Kartografiya i Aerofotosemka (USSR), no. 7, 1968 p 15-24
(AD-704202; FTD-MT-24-392-69) Avail: CFSTI CSCL 8/5

The problem of the theory and practice of geodesic leveling is studied. Special experimental investigations in the winter of 1966 on the variation of the refractive index during winter are described. The authors worked in the hilly and wooded areas of the Volyno-Podolsk elevation. The grid points were mainly on hill tops not more than 40 meters difference in height and were 5 to 20 kilometers apart. The only other similar work was in the winter of 1953-1954 in the Carpathians, which determined the refractive index as a function of temperature and time of day and season. The present work concludes: (1) the refractive index assumes its greatest values in winter; (2) the diurnal curve possesses a clearly expressed asymmetry exaggerated in the morning; (3) the refractive index increases with negative temperatures and with prevailing positive gradient of the equivalent height; (4) the lower the height of the line of sight, the larger the amplitude of the diurnal curve of the index; (5) under winter conditions no leveling of the index is generally observed from directions of low equivalent heights, leveling of the index is possible only near midday hours at large equivalent heights; (6) for negative temperatures the accuracy of measurements of zenith distances is 1.5 times higher than for positive temperatures. Author (TAB)

N70-31747*# Martin Marietta Corp., Denver, Colo.
CONTAMINATION CONTROL HANDBOOK FOR GROUND FLUID SYSTEMS Final Technical Publication
Hubert N. Allen and Victor A. Des Camp Sep. 1969 65 p refs
(Contract NAS10-5935)
(NASA-CR-110506; GP-871; MCR-69-485) Avail: CFSTI CSCL 08M

This handbook has been prepared to assist designers and other interested persons in dealing logically and intelligently with the problems posed by particulate contamination in ground fluid systems. Major topics discussed include: (1) the nature of contamination; (2) the effects of contamination; (3) the determination and attainment of required levels of initial cleanliness; and (4) considerations during design, and maintenance of operational cleanliness levels. Author

N70-31756# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE PRINCIPLE WEST GERMAN TRIANGULATION NET AS PART OF THE MAIN EUROPEAN TRIANGULATIONS. SERIES B: RELATED GEODAESY, NO. 172, PART 2 [DAS WESTDEUTSCHE HAUPTDREIECKSNETZ ALS ANTEIL ZU DEN EUROPAEISCHEN HAUPTNETZTRIANGULATIONEN (RETRIG). REIHE B: ANGEWANDTE GEODAESIE, HEFT 172, TEIL 2]
Hans-Joachim Spiess 1969 245 p refs In GERMAN *Its* Mitt. No. 116, pt. 2
Avail: CFSTI

Presented are descriptions of the various stations as well as data for excentric points. Also included are references for geodetic work performed at the stations of the principle West German triangle net and at remote stations. Transl. by G.G.

N70-31762# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE POSSIBILITY OF DETERMINING THE VERTICAL DISTRIBUTION OF THE MICROWAVE RADIATION OF THE EARTH ATMOSPHERE SYSTEM
E. P. Dombkovskaya 14 Jan. 1970 16 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1969 p 8-14
(Contract NOw-62-0604-c)
(AD-703994; APL-CLB-3-T-619) Avail: CFSTI CSCL 4/1

The possibility of determining the vertical distribution of water vapor in a cloudless atmosphere from measurements of the microwave radiation of the earth-atmosphere system at two or more wavelengths is pointed out. Values of the correlation coefficients between the water-content of various layers of the atmosphere and the radio-brightness temperatures at various wavelengths are given, together with the regression equation relating these quantities. Data are given for checking the regression equation with independent data. Author (TAB)

N70-31789# Army Dept., Washington, D.C. Assistant Chief of Staff for Intelligence.
PHYSICAL GEOGRAPHY OF THE USSR
G. K. Tushinskii 5 Feb. 1970 738 p refs Transl. into ENGLISH of the book "Fizicheskaya Geografiya SSSR" Moscow, Prosveshcheniye, 1966 p 3-813
(AD-703032; ACSI-J-6585) Avail: CFSTI CSCL 8/6

Contents: Size, geographical position and boundaries of the USSR; Orography; Geological structure; Seas of the Soviet Union; Climate; Variation in humidity within the territory of the USSR during historic times; Inland waters; Permafrost; Contemporary glaciation; Natural geographical zones; and Physico-geographical zoning of the territory of the USSR agroclimatic zoning of the USSR. TAB

N70-31789# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FORMATION OF NEGATIVE TEMPERATURE GRADIENTS NEAR A WATER SURFACE
S. P. Malevskii-Malevich 20 Jan. 1970 13 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 3, 1969 p 53-59
(Contract NOw-62-0604-c)
(AD-703992; APL-CLB-3-T-620) Avail: CFSTI CSCL 8/10

Based on estimates of the components of the thermal balance of the sea surface, an expression is derived relating the magnitude of the negative temperature gradients in the water near the surface (Tp -TH) with the drop in temperature of the water-air surface. The profile of the thermal conductivity coefficient lambda in the upper 2-cm layer of water is given. The results of computing lambda with various wind speeds are given. Using measured data on (Tp -TH), ocean surface evaporation is computed from the known heat exchange in the surface layer. Author (TAB)

N70-31900# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THE AEROSPACE CORPORATION SPACE SCIENCE PROGRAM REPORT TO COSPAR CY 1969
G. A. Paulikas, comp. 31 Dec. 1969 26 p refs
(Contract F04701-69-C-0066)
(AD-703710; TR-0066(5260-01)-1; SAMSO-TR-70-111) Avail: CFSTI CSCL 4/1

Results obtained during 1969 by the space research programs of The Aerospace Corporation are presented. The results deal primarily with studies of the upper atmosphere, radiation belt physics, and the interaction of solar cosmic rays with the magnetosphere. Author (TAB)

N70-31979# Environmental Research Corp., Alexandria, Va.
SEISMIC MOTIONS FROM PROJECT RULISON
Peter C. Loux [1970] 19 p refs Presented at the Meeting on Eng. with Nucl. Explosives, 4th Plowshare Symp., Las Vegas, Nev., Jan. 1970 Sponsored in part by AEC
(PNE-R-18; CONF-700101-10) Avail: CFSTI

In the range from a few to a few hundred kilometers, seismic measurements from the Rulison event were found and compared with experimentally and analytically derived pre-event estimates. Seismograms, peak accelerations, and response spectra are given along with a description of the associated geologic environment. Techniques used for the pre-event estimates are identified with emphasis on supportive data and on Rulison results. Of particular interest is the close-in seismic frequency content which is expected to contain stronger high frequency components. This higher frequency content translates into stronger accelerations within the first tens of kilometers, which in turn affect safety preparations. The local geologic structure at nearby population centers must be considered. The geologic parameters are then used as input to seismic amplification models which deliver estimates of local resonant frequencies. Prediction of such resonances allows improved safety assurance against seismic effects hazards. Author (NSA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-30610*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
TASK 5 OUTGASSING APPARATUS AND GAS ANALYSIS DATA, APPENDIX I
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 22 p (See N70-30602 16-33)
Avail: CFSTI CSCL 06L

A schematic of the outgassing apparatus is shown. The insulation specimen is placed in the specimen chamber, which is 6 in. in diameter and 1 1/2 in. deep. The chamber walls and all plumbing lines are of stainless steel because of the low outgassing characteristic of this material. The specimen chamber is sealed from above by a 6 in. vacuum flange with a Teflon gasket. Three thermocouples are provided within the specimen chamber. The top of the chamber is the base of the cryogen tank. The tank is used to provide a constant temperature environment to the specimen chamber. Low thermal-conductivity fill-and-vent lines enter the cryogen tank through its top. The cryogen tank/specimen chamber assembly is enshrouded within an outer vacuum jacket used to assist in thermally isolating this assembly. Author

N70-30732*# Techtran Corp., Glen Burnie, Md.
ACTINOMETRIC EQUIPMENT OF SOVIET WEATHER SATELLITES
V. A. Besking et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 1-7 (See N70-30731 15-20)
Avail: CFSTI CSCL 04B

The operation principles and main characteristics of actinometric equipment of weather satellites installed on Soviet satellites Kosmos-122, Kosmos-144, and Kosmos-156 are presented. The optical systems are described and illustrated, and the system of collection of actinometric information is analyzed. Author

N70-30733*# Techtran Corp., Glen Burnie, Md.
PRINCIPLES OF CALIBRATION OF LONGWAVE ACTINOMETRIC INSTRUMENTS ON WEATHER SATELLITES
L. B. Krasilshchikov *In its* Satellite Meteorology, No. 221 Jun. 1970 p 8-14 refs (See N70-30731 15-20)
Avail: CFSTI CSCL 04B

The method of calibrating longwave actinometric instruments of the satellites by means of laboratory vacuum simulators of black radiation is presented. Author

N70-30734*# Techtran Corp., Glen Burnie, Md.
INFORMATION PROPERTIES OF SCANNING INFRARED EQUIPMENT OF WEATHER SATELLITES
A. A. Kmito et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 15-23 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Root-mean-square errors of the quantum signal in measuring the radiant flow is determined. The errors caused by the action of the unstabilizing factors are examined applicably to the two channel optical system, the measure for indeterminancy being the convention entropy. The probability of detection of the signal is evaluated under the condition of independence of the signal and noise, and also under the action of the normally distributed radiant flow and noise on the system. An expression for the probability of detection of the signal is obtained, and the loss of information caused by the indeterminancy in detection of the signal is determined. In conclusion a complete expression for the evaluation of information properties of the equipment of weather satellites is given. Author

N70-30828*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYBRID THERMOCOUPLE DEVELOPMENT PROGRAM: A STATUS REPORT
W. J. Bifano, L. P. Garvey, and R. A. Straight [1970] 14 p ref Proposed for presentation at 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21-24 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52834) Avail: CFSTI CSCL 14B

The description and development status of a Hybrid thermocouple, which employs both PbTe and SiGe thermoelectric materials, is presented. Hybrid couple performance is predicted by means of an analytical model and beginning-of-life couple efficiency is compared to that of an all SiGe couple. A preliminary design of a planar RTG, employing Hybrid couples and a water heat pipe radiator, is described as an example of a possible power system application. Author

N70-30856*# Aztec School of Languages, Inc., Maynard, Mass.
CALIBRATION OF INFRARED SPECTROPHOTOMETERS
S. V. Ashcheulov *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 18-22 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 20F

The problems encountered in calibration of infrared spectrophotometers are discussed. It is shown that a design with

automatic regulation of black body temperature, with cooling, which involves the use of semiconducting condenser batteries, is very compact and reliable. Author

N70-30862*# Aztec School of Languages, Inc., Maynard, Mass.
APPLYING STATISTICAL METHODS TO SOME PROBLEMS IN SPECTROSCOPY
A. P. Galtsev et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 127 - 144 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 06F

Using some statistical methods of spectroscopy, calculation of threshold scales yields that the ranges of concentration of matter can be determined (within measurement accuracy), making it possible to improve measurement conditions and predict the applicability of the instrument to specific cases. With maximum accuracy in concentration measurement, the optimal path length of the ray in the absorbing medium can be determined. Author

N70-30864*# Aztec School of Languages, Inc., Maynard, Mass.
SPECTROPHOTOMETER WITH A NORMAL EMISSION SPECTRUM AT THE OUTPUT OF THE RECORDER
V. V. Mikhaylov et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 153 - 158 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 06F

A spectrophotometer is described whose operative model was designed in the special research laboratory of atmospheric physics. The instrument was designed to avoid two basic difficulties: low speed for recording spectra, and selectiveness of the sensitivity of the device. Author

N70-30866*# Aztec School of Languages, Inc., Maynard, Mass.
SOME PROBLEMS IN THE METHOD OF ANALYZING THE RESULTS OF OBSERVATIONS OF RADIATION BALANCE COMPONENTS
G. A. Nikolskiy et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 168 - 178 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 14B

The errors in measurements of the radiation balance which are connected with a deviation of sensitive areas of pyranometers from a horizontal position are discussed in relation to 19 airship flights carried out from 1961 to 1965. The effects of the temperature and pressure, the envelope of the airship, spectral and angular corrections, and calibration are considered. Author

N70-30868*# Aztec School of Languages, Inc., Maynard, Mass.
AN OZONE SONDE FOR MEASURING THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE
L. G. Bolshakova *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 189 - 199 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 14B

The apparatus used for measuring the vertical distribution of atmospheric ozone, as well as the measurement method is described. An analysis showed that, with this method, the scattered light of the sky incident on the measuring instrument has a great effect on the change in the signal of the ozone sonde with altitude in the lower layers of the atmosphere. Author

N70-30874*# Aztec School of Languages, Inc., Maynard, Mass.
THE EFFECTIVENESS OF DEPOSITING AEROSOL PARTICLES ON A PLANE BACKING
L. S. Ivlev *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 247 - 255 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 14B

An experiment to evaluate the effectiveness of depositing aerosol particles on different kinds of plane backings was planned. It is shown that collectors of the impactor type must be standardized in order to obtain representative measurements. Author

N70-30922*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
ORBITAL IMAGERY FOR PLANETARY EXPLORATION. VOLUME 4: IMAGING SENSOR SYSTEM SCALING LAWS
D. Klopp Sep. 1969 322 p refs
(Contract NAS2-4494)
(NASA-CR-73453) Avail: CFSTI CSCL 17H

The origin, development, and utilization of scaling laws which characterize the operation of selected imaging sensor systems are described. These scaling laws permit preliminary design of space-orbital imaging systems with due regard to the nature of the desired imagery and the orbit configuration. Author

N70-30923*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
ORBITAL IMAGERY FOR PLANETARY EXPLORATION. VOLUME 5: SUPPORT REQUIREMENTS FOR PLANETARY ORBITAL IMAGING
D. A. Klopp, comp. Oct. 1969 316 p
(Contract NAS2-4494)
(NASA-CR-73454) Avail: CFSTI CSCL 17H

Support requirements for planetary orbital imaging experiments are estimated. These support requirements represent the demands imposed upon spacecraft support subsystems by the experiment. That is, they describe quantitatively the important interfaces between the experiment subsystem and the remainder of the spacecraft. These requirements depend upon the purpose of the experiment, the design details of the imaging sensor system used to perform the experiment, and the orbit from which the experiment is performed. Author

N70-30994# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING, VOLUME 12, NO. 10, 1968
N. L. Artemev et al 7 Jan. 1970 55 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 12, no. 10, 1968 p 45 - 61
(AD-702970; FTD-MT-24-342-69) Avail: CFSTI CSCL 14/5

Contents: LI-405 in a regime of pulse illuminations; The organization for showing the winter olympic games from Grenoble on television; Certain peculiarities of filming movie materials for television; Standardization and normalization methods of testing of motion-picture lenses. TAB

N70-30999# National Aerospace Lab., Tokyo (Japan).
ANALYSIS OF THE ANISOELASTIC ERRORS OF A FLOATED SINGLE DEGREE OF FREEDOM INTEGRATING GYRO
Masao Otsuki, Hirokimi Shingu, Jyoji Tabata, Takao Suzuki, and Shigeharu Enkyo 1970 11 p refs In JAPANESE; ENGLISH summary
(NAL-TR-188) Avail: CFSTI

A floated single-degree-of-freedom integrating gyro is used to sense angular rates of vehicle motion, but senses the errors called drift rates by applying the acceleration whose direction is perpendicular to its output axis. The drift rate, which is proportional to the square of acceleration magnitude, is caused by a difference in compliance of the gimbal between the input axis and the output axis, and is called anisoelastic error. The anisoelastic error was analyzed theoretically and experimentally through derivation of the theoretical formula, tumbling test, vibration experiment, and simulation. When vibrational accelerations were applied to the gyro, the anisoelastic error grew remarkably over a certain frequency range because of a difference in natural resonant frequency depending on the anisoelasticity, and was the same as that caused by steady acceleration at the frequency without the influence of natural resonance. The experimental results of the anisoelastic error were closely proportional to the square of acceleration magnitude, and

their frequency characteristics showed a tendency similar to the simulations. Author

N70-31038# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TESTING OF AIRCRAFT INSTRUMENTS
P. I. Bulovskii et al 14 Jan. 1970 316 p refs Transl. into ENGLISH from the Russian
(AD-702973; FTD-HT-23-163-68) Avail: CFSTI CSCL 1/4

The book presents metrological fundamentals and methods of check tests of aircraft instruments (navigation, for monitoring the engine operation, gyroscopic, combined), as well as the design arrangements of testing facilities, methods for adjusting and checking them. Characteristic features of organizing typical inspection processes and multiunit servicing are also considered. Author (TAB)

N70-31100# Scientific Translation Service, Ann Arbor, Mich. Argonne National Lab., Ill.
AUTOMATION OF THE MEASUREMENT OF REACTIVITY
A. A. Voronin et al Mar. 1970 18 p refs Transl. into ENGLISH from the Russian Transl. for Argonne Natl. Lab.
(ANL-Trans-820; IAE-1689) Avail: CFSTI

A general comparative evaluation of the possibilities of the automatic measurement of reactivity is discussed from the point of view of experimental possibilities, expenditure of time, and safety. The analytical description of the method is based on the statements of the theory of invariance and utilizes the device of symbolic transfer functions and differential equations. The main results of the investigation are related to building a semiconductor reactivity meter of the type PIR-2 and its experimental utilization in the MR and IRT-M research reactors at the I. V. Kurchatov Atomic Energy Institute. Author (NSA)

N70-31167# Toegepast Natuurwetenschappelijk Onderzoek, Delft (Netherlands). Chemisch Lab.
THE INFLUENCE OF METERODISPERSITY OF AN AEROSOL ON PENETRATION MEASUREMENTS [INVLOED VAN DE HETERODISPERSITEIT VAN EEN AEROSOL OP PENETRATIEMETINGEN]
A. Bos Sep. 1969 37 p refs In DUTCH; ENGLISH summary
(Rept-1969-18) Avail: CFSTI

The influence of the heterodispersity of an aerosol on the measurements was investigated by means of the optical concentration meter and the apparatus for particle size determination. A method was developed to determine the heterodispersity of the aerosol, using penetration measurements of two filters, used in series. Author

N70-31180# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DISCRIMINATION OF MAGNETIC ANOMALIES DISTRIBUTED BY A GIVEN DIPOLE [DISCRIMINATION D'ANOMALIES MAGNETIQUES DISTRIBUEES PAR UN DIPOLE DEFINI]
Guy Chiron (Ph.D. Thesis—Grenoble Univ., 6 Nov. 1969) Apr. 1970 79 p refs In FRENCH; ENGLISH summary
(CEA-R-3956) Avail: CFSTI

Research into submerged magnetic masses with dipole characteristics can be carried out with sensitive NMR or other magnetometers which give a signal with frequency proportional to the magnetic field and a voltage proportional to this frequency. Equipment was designed for automatically selecting the signals corresponding to the masses being detected. It is based on the spectral analysis of the signal as the perturbations of interest are in the 0.037 - 0.47 Hz frequency band. The apparatus gives a pulse if the signal is of interest otherwise it remains at zero. In the former case a buoy or beacon can be left to mark the site. Author (ESRO)

N70-31187# European Space Research Inst., Frascati (Italy).
A PARALLEL PLATE ELECTROSTATIC ANALYZER
T. S. Green and G. A. Proca Nov. 1969 25 p refs
(ESRIN-IN-61) Avail: CFSTI

A description is given of a new parallel plate electrostatic analyzer. It is shown that a previously used instrument in which charged particles issuing from a source on the earth plate and travelling at a mean angle of 45 deg to this plate is deflected and brought to a focus on the plate, is a singular though simple example of more general focusing properties of a parallel plate analyzer. From consideration of these properties it has been found possible to select a given angle of entry into the field for which second order focusing can be attained giving rise to an angular aberration term alpha (Delta Theta) to the 3rd power. Using an acceptance of + or - 6 deg, a resolving power of 200 is predicted and has been obtained with a prototype. Author (ESRO)

N70-31189# California Univ., Livermore. Lawrence Radiation Lab.
A DISPLACEMENT BEAM TRANSDUCER FOR MEASURING LARGE DISPLACEMENTS AT HIGH VIBRATION FREQUENCIES
Scott E. Hassett 24 Feb. 1970 8 p Sponsored by AEC
(UCRL-50814) Avail: CFSTI

A transducer is described which was developed to measure large displacement at high vibration frequencies. The basic design consists of an arm pinned at one end and attached at the other end to the test sample being measured. A strain gage attached to a short cantilever beam measures the motion of the arm at a point close to its pinned end where displacements are small. The short length of the cantilever beam results in a natural frequency higher than the highest test frequencies. The design of the transducer was optimized for a minimum mass and a voltage output from the strain gage that was independent of frequency. Author

N70-31207# Los Alamos Scientific Lab., N.Mex.
NEUTRON MEASUREMENT USING THERMOLUMINESCENT DOSIMETERS
Morris J. Engelke 25 Mar. 1970 9 p refs
(Contract W-7405-eng-36)
(LA-4335) Avail: CFSTI

A method of determining the average neutron energy and fluence in a radiation field is described. Miniature thermoluminescent dosimeters are employed as detectors embedded in a moderating medium consisting of an 18-in.-diam polyethylene sphere. The equipment, calibration procedures, and results are described. A comparison of experimental measurements to transport theory calculations of sphere-counting efficiencies is made. The approximate average neutron energy can be established easily and quickly in the neutron-energy range from 500 keV to 20 MeV. The practical use and limitations at accelerators where the particle energies are less than 20 MeV are discussed. Author (NSA)

N70-31219# Brookhaven National Lab., Upton, N.Y.
AMPLITUDE DISTRIBUTIONS OF THE POISSON PROCESS TRANSFORMED BY SYSTEMS WITH MEMORY, WITH SPECIAL REFERENCE TO SHOT NOISE AND PILE-UP
B. Soucek, M. Cimerman (Inst. Rudjer Boskovic) and B. Breyer (Inst. Rudjer Boskovic) [1969] 17 p refs Presented at the 12th Scintillation and Semicond. Counter Symp., Washington, D.C. Sponsored in part by AEC
(BNL-14487; Conf-700301-5) Avail: CFSTI

Many physical and biological phenomena can be described by a transformation of the Poisson process. Such processes have been simulated by the computer for various amplitude distributions and response functions which are common for processing of signals from nuclear detectors. The following amplitude distributions have been analyzed: delta functions, gaussian, exponential,

rectangular, and typical nuclear spectra. The system impulse response functions can have arbitrary shapes, such as exponential, RC integrated and/or differentiated, cusp, bipolar, etc. The following cases have been analyzed: continuous time series; pulsed time series (pulsed accelerator case); pulse shaping networks for minimal distorations at high rates; pile-up rejection systems; shot noise; systems with finite resolving time. A large number of cases have been simulated and systematically investigated, and probability density functions for each case are shown. Author (NSA)

N70-31245# Michigan Univ., Ann Arbor. Inst. of Science and Technology.

TARGET TEMPERATURE MODELING Final Report, 22 Dec. 1967 - 22 Jun. 1969

D. Bornemeier, R. Bennett, and R. Horvath Griffiss AFB, N.Y. RADC Dec. 1969 108 p refs

(Contract F30602-68-C-0099)

(AD-704170; Rept-1588-5-F; RADC-TR-69-404) Avail: CFSTI CSCL 17/4

A computerized mathematical model for the prediction of time-dependent surface temperatures and radiances of planar targets and backgrounds has been formulated. The model accounts for the effects of (1) solar insulation, (2) radiative transfer, (3) natural and forced convection, (4) rain evaporation, (5) thermal properties and physical configuration of the target, and (6) internally generated heat fluxes. Additional capabilities of the model include estimates of target background contrast as a function of time-dependent meteorological environment and scanner parameters. An automatic machine-plotting capability has been incorporated in order to provide immediately interpretable forms for the results. Author (TAB)

N70-31259# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FFTF STATE-OF-THE-ART REPORT FOR LOW LEVEL NEUTRON FLUX INSTRUMENTATION

C. N. Jackson, Jr. Feb. 1969 21 p refs

(Contract AT(45-1)-1830)

(BNWL-948) Avail: CFSTI

Topics briefly discussed include fuel element failure detection by delayed neutron monitoring, neutron detectors, and low-level neutron flux instrumentation. NSA

N70-31260# Nuclear Materials and Equipment Corp., Lewiston, N.Y. Niagara Div.

THE VERIFICATION OF ELEMENTAL BORON CRYSTALLINITY BY X-RAY DIFFRACTION

R. T. Marano and E. R. Shuster 18 Dec. 1969 9 p

(Contract AT(40-1)-3292)

(NUMEC-3292-14) Avail: CFSTI

A diffractometer procedure for determining crystallinity of elemental boron has been developed. It is recommended as an alternate or replacement for the X-ray diffraction camera technique required by the specification for this material. Author (NSA)

N70-31296# Commissariat a l'Energie Atomique, Gernoble (France). Centre d'Etudes Nucleaires.

CONSTRUCTION OF A MULTIPARAMETER ANALYZER WITH TIME-OF-FLIGHT SPECTROMETRY FOR FAST NEUTRONS AND GERMANIUM SPECTROMETRY FOR 0.2 TO 15 MeV PHOTONS: APPLICATION TO THE REACTIONS (n gamma) AND (n,n' gamma) [REALISATION D UN ANALYSEUR MULTIPARAMETRIQUE LAVEC SPECTROMETRIE PAR TEMPS-DE-VOL POUR LES NEUTRONS RAPIDES ET SPECTROMETRIE A GERMANIUM POUR LES PHOTONS DE 0.2 A 15 MeV: APPLICATION A L'ETUDE DES REACTIONS (n, gamma) ET (n,n' gamma)]

Claude Sonrel (Ph.D. Thesis—Grenoble Univ., 27 Nov. 1969) Apr. 1970 89 p refs In FRENCH; ENGLISH summary Sponsored by CEA, Grenoble

(CEA-R-3981) Avail: CFSTI

The excellent energy resolution obtainable with a germanium crystal was used to study the gamma radiation produced by inelastic scattering and by 14 MeV neutron capture. A study was made as a function of the volume (up to 120 cu cm) of these Ge (Li) detectors of the problems arising from the good time resolution (approximately 2 nsec) and the detection of 0.2 to 20 MeV photons (resolution, efficiency). This spectrometer was coupled to a fast neutron (less than or = to 14 MeV) time-of-flight spectrometer; the multi-parameter analyzer was linked directly to an IBM 360/50 computer through a liaison network. This equipment was built for studying reactions of the type (n,n' gamma) on Li 7, C 12 and O 16. Author (ESRO)

N70-31303# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

EVALUATION OF THE SPERRY ULTRASONIC WHEEL INSPECTION UNIT

R. W. Smith and N. L. Johnson Feb. 1970 58 p refs

(Contract AT(45-1)-1830)

(BNWL-1302) Avail: CFSTI

The Sperry wheel ultrasonic inspection unit was evaluated for remote surveillance of the FFTF pressure vessel during reactor shutdown. Facilities of testing transducers and transducer components in the FFTF environment were developed. A number of materials were tested for use in the FFTF environment. It was found that the Sperry wheel has three drawbacks which make it unsuitable for use in the FFTF environment: 1) it cannot be used on a dry surface, 2) a number of the components will not tolerate the projected environment, and 3) the acoustic noise level is too high for FFTF surveillance. Author (NSA)

N70-31333# Naval Research Lab., Washington, D.C. Ocean Sciences Div.

ATMOSPHERIC POTENTIAL-GRADIENT MEASUREMENTS AT SEA

Stuart G. Gathman and Eva Mae Trent 24 Feb. 1970 23 p refs

(AD-703212; NRL-7030) Avail: CFSTI CSCL 4/1

Shipboard measurements of atmospheric potential gradient are discussed. A comparison is made at sea between the performance of a potential-measuring apparatus and a field mill. The design of electrometer input multistage voltage followers is presented as a solution to the degradation of insulators by the salt environment. A model is given which calculates from the ships engine power and the relative wind vector the potential gradient due to the charged stack gas. A method is also described by which a reduction factor can be calculated so that the geometric distortion of a ships superstructure is accounted for in potential-gradient measurements. Author (TAB)

N70-31387# Los Alamos Scientific Lab., N.Mex.

SCHLIEREN PHOTOGRAPHY: A BIBLIOGRAPHY

Jean Furnish, comp. 11 Mar. 1970 4 p refs

(Contract W-7405-eng-36)

(LA-4380) Avail: CFSTI

The entries in the bibliography are arranged alphabetically by author's name. Sources checked are as follows: Abstracts of Photographic Science and Engineering Literature, Vol. 8 (1969); International Aerospace Abstracts, Vol. 9 (1969); Nuclear Science Abstracts, Vol. 23 (1969); Physics Abstracts, Vol. 72, No. 853-878 (January-December 18, 1969); Scientific and Technical Aerospace Reports, Vol. 7 (1969); and U. S. Government Research and Development Reports, Vol. 69 (1969). Author

N70-31443# Atomic Energy Commission, New York. Health and Safety Lab.
NEUTRON DOSE EQUIVALENTS FROM MULTISPHERE ACCELERATOR-SHIELD LEAKAGE SPECTRA
M. S. Weinstein, F. Hajnal, J. E. Mc Laughlin, and K. O'Brien Mar. 1970 23 p refs
(HASL-223) Avail: CFSTI

Multisphere spectrometric measurements of accelerator stray neutrons were used in an exploratory study of dose equivalent distributions with neutron energy. Results indicate that a substantial fraction of the dose equivalent from neutrons occurs in the energy range below about 0.4 MeV, the threshold of thin personnel monitoring emulsions. Even above this threshold, the emulsion is required to perform very well as a fast neutron dosimeter to measure the contribution of the neutrons and to account for the major part of the dose equivalent. The results also indicate that representing an accelerator leakage spectrum as a simple energy value to infer dose information may be misleading. It is believed that supplementary measurements, such as with moderating spheres, are almost a necessity. Author (NSA)

N70-31497# Lincoln Lab., Mass. Inst. of Tech., Lexington.
VERY LONG BASELINE INTERFEROMETRY AS A MEANS OF WORLDWIDE TIME SYNCHRONIZATION
Alan E. E. Rogers and James M. Moran, Jr. 17 Feb. 1970 16 p refs
(Contract AF 19(628)-5167)
(AD-704134; ESD-TR-70-34; TR-478) Avail: CFSTI CSCL 14/2

Extraterrestrial radio waves from sources of small angular size can be used to synchronize clocks at two receiving sites to a high degree of precision. Radio star signals, together with time identification, are recorded on magnetic tape. Tapes are subsequently processed on a digital computer to obtain the synchronization error between the two clocks at the time of observation. The ultimate limit to the precision of the method is the knowledge of the relative signal delay in the atmosphere and ionosphere. Author (TAB)

N70-31546# California Univ., Livermore. Lawrence Radiation Lab.
METHOD FOR EVALUATION AND CERTIFICATION OF THE FERRANTI X-Y COORDINATE MEASURING MACHINE
Donald L. Lane Nov. 1969 25 p
(UCRL-50782) Avail: CFSTI

This report describes 15 evaluation and certification tests developed at the Lawrence Radiation Laboratory for the Ferranti X-Y Coordinate Measuring Machine. Photographs of each test setup are included. Author (NSA)

N70-31547# Midwest Research Inst., Kansas City, Mo.
A STUDY OF THE ELECTRIC DEFLECTION OF MOLECULAR BEAMS Final Annual Report, Jul. 1968 - Jun. 1969
Frank T. Greene and Thomas A. Milne Jun. 1969 46 p refs
(Contract AF 49(638)-1724)
(AD-703707; AFOSR-69-2081TR) Avail: CFSTI CSCL 7/4

An electric deflection molecular beam system with a mass spectrometric detector has been built and tested and is operating satisfactorily. The entire system is bakeable to 400C in order to minimize interfering background gases, and can be operated at pressures approaching 10 to the -10th torr. Computer data reduction schemes for nonpolar and linear molecules having both permanent and induced electric moments have been developed and tested and are in use. The system has been applied to the study of alkali metals and their dimers and alkali metal halides and their polymers. Author (TAB)

N70-31616# Technische Hochschule Munchen (West Germany).
ELECTRON- AND BREMSSTRAHLUNG DOSIMETRY OF A VAN DE GRAAFF ACCELERATOR IN THE ENERGY REGION OF 0.75 TO 3 MeV AND RADIATIVE FLUXES TO 1 MA [DOSIMETRIE DER ELEKTRONEN- UND BREMSSTRAHLUNG EINES VAN DE GRAAFF BESCHLEUNIGERS IM ENERGIEBEREICH VON 0.75 BIS 3 MEV UND STRAHLSTROEMEN BIS 1 MA]
Robert Ettl (Ph.D. Thesis) 1969 112 p refs In GERMAN
Avail: CFSTI

Ionization methods as well as calorimetric and chemical methods are described for the determination of absorbed energy from ionization measurements in air. Necessary modifications of extrapolation chambers for the dosimetry of electron radiation are discussed and an extrapolation flow chamber is described. Thermodynamics and construction of a differential pressurized flow calorimeter with suitable materials for total absorption is outlined. Also discussed are commercial ionization chambers for their suitability in X-ray dosimetry. Accelerometer measurements outlined cover: (1) the dependence of electron dosage on the location; (2) the dependence of the characteristic dosage for X-rays on current and voltage of the accelerator, and (3) several half value layer measurements on X-rays filtered through copper and lead barriers. Transl. by G.G.

N70-31617# Sylvania Electronic Systems-Central, Williamsville, N.Y.
LIGHT OBSERVATION HELICOPTER AVIONICS PACKAGE (LOHAP) Final Advance Engineering Production Report
6 Mar. 1970 94 p ref
(Contract DA-28-043-AMC-01943(E))
(AD-703022; Rept-00-153968) Avail: CFSTI CSCL 1/3

Contents: Production plan; (Assembly and test floor plan; Detail job breakdown for each operator and technician; Manufacturing drawings and instructions for each operation; Assembly, inspection and test procedures; Material control and production schedule plan for specified rates; Production specifications; Bills of materials; Cross reference index; Tooling drawings); Production tools, fixtures and test equipment; and Estimate of production line yields. TAB

N70-31622# Naval Missile Center, Point Mugu, Calif. Systems Integration Div.
JANAIR VERTICAL ANALOG DISPLAY EVALUATION PROGRAM Annual Report, Jan. 1968 - Jan. 1969
K. D. Cross, O. M. Powers, F. R. Cavallero, and A. C. Bittner, Jr. 20 Mar. 1970 39 p refs
(AD-703218; NMC-TP-70-12; JANAIR-690111) Avail: CFSTI CSCL 1/4

The report summarily describes the efforts expended and the task accomplishments for the JANAIR Vertical Contact Analog Display Evaluation Program. The reporting period covers all of calendar year 1968. In addition to a reiteration of program objectives, the following topics are discussed: development of laboratory facilities, development of research methodology, research accomplishments to date, and analytical studies performed. Author (TAB)

N70-31636# Naval Research Lab., Washington, D.C.
COINCIDENT NEUTRON EQUIPMENT
Charles V. Strain and Robert J. Omohundro Mar. 1970 51 p refs
(AD-703616; NRL-MR-2107) Avail: CFSTI CSCL 18/4

Coincident neutron detectors have been developed which can distinguish between neutrons occurring as a result of fission and those due to (alpha,n) or (gamma,n) nuclear reactions. These detectors are described and several examples of their use are

reported. Theoretical relations which predict count rates as a function of sample and equipment characteristics are developed. These permit the potential usefulness of coincidence measurements to be ascertained for any given set of circumstances. Author (TAB)

N70-31650*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
KINETIC ELECTRON TEMPERATURE MEASUREMENT TECHNIQUES FOR HELIUM
Victor E. Scherrer Washington Jun. 1970 12 p refs
(NASA-TN-D-5849; C-124) Avail: CFSTI CSCL 20M

Spectroscopic techniques for measuring the temperature of helium for temperatures between 1.3eV (15,000 K) and 100eV (1,160,000 K) were investigated. A transient plasma source capable of temperature variation by changing input current amplitude and frequency was developed. A systematic study was made of four spectroscopic measurement techniques for temperatures in the range 1.3eV to 100eV. Recommendations are made for the development of an instrument capable of measuring temperatures with an estimated accuracy of 20 percent. Author

N70-31732*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFRARED INTERFEROMETER EXPERIMENT ON NIMBUS 3
B. J. Conrath, R. A. Hanel, V. G. Kunde, and C. Prabhakara Jun. 1970 75 p refs Submitted for publication
(NASA-TM-X-63953; X-620-70-213) Avail: CFSTI CSCL 17E

The Michelson interferometer experiment carried on the Nimbus 3 satellite has successfully obtained thermal emission spectra of the earth and atmosphere. Comparison of a measured spectrum with a spectrum calculated theoretically from near-simultaneous radiosonde measurements indicates generally good agreement over most of the spectral range covered. A preliminary search for spectral features due to minor atmospheric constituents other than CO2, H2O, and O3 has resulted in a positive identification of only CH4 thus far. Comparisons of temperature profiles estimated from selected spectra with those obtained from radiosonde measurements on both an individual basis and in the form of maps for selected locations and times indicate that meaningful atmospheric temperatures can be obtained, even in the presence of clouds. Similar comparisons of water vapor estimates with radiosonde measurements demonstrate that good humidity profiles can be obtained under essentially clear sky conditions, but when clouds are present within the field-of-view, the estimates become unreliable. Total ozone amounts in an atmospheric column obtained from the spectra are in generally good agreement with Dobson spectrometer measurements, and the estimates are found to be insensitive to clouds within the field-of-view under most circumstances. Author

N70-31798*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A 4-MICROSECOND FLASHING LIGHT SYNCHRONIZED WITH FRAMING OF MOTION-PICTURE CAMERAS AND ITS APPLICATION IN SCHLIEREN PHOTOGRAPHY
Walter F. Lindsey and Joseph Burlock Washington Jun. 1970 35 p refs
(NASA-TN-D-5858; L-7003) Avail: CFSTI CSCL 14E

A photographic system was developed and operated wherein a 1000-watt mercury-vapor lamp is flashed in synchronization with the framing of 16-millimeter high-speed and 35-millimeter low-speed cameras. The flash of light has a duration of about 4 microseconds and is triggered either by a generated sinusoidal voltage at high speeds or by a make-break switch at low speeds. The system is capable of flashing at rates from below 10 to about 1400 per second. The recording system was developed and operated in Schlieren photography of flows in aerodynamic research. This Schlieren system was expanded by the addition of an independent channel that permits visual monitoring of the test conditions at will and independent of the recording system. The light, controls, and cameras of the recording system are applicable to other studies involving rapid motion such as those encountered in processing and in machinery. Author

N70-31846*# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
LARGE TELESCOPE EXPERIMENT PROGRAM (LTEP) Executive Summary
24 Apr. 1970 41 p ref
(Contract NAS8-21497)
(NASA-CR-102767; Rept-9800-Summ) Avail: CFSTI CSCL 17/8

The large experiment telescope program (LTEP) was undertaken to study the feasibility of implementing a two-meter system in either a piggyback or an independent configuration, to select and recommend a baseline LTEP implementation approach, and to define the technology efforts required to initiate the recommended implementation. It is concluded that the two-meter system can be implemented if the launch date is set for mid-1975 or later Author

N70-31847*# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
LARGE TELESCOPE EXPERIMENT Program (LTEP), Volume 1, Part 1
24 Apr. 1970 370 p refs
(Contract NAS8-21497)
(NASA-CR-102768; Rept-9800-Vol-1-Pt-1) Avail: CFSTI CSCL 17H

The design requirements for the telescope system are summarized and the various components of the system are described and illustrated. The primary objective of the program is to develop a three-meter monolithic diffraction-limited system from a precursor two meter system. The technological gaps to be overcome and the precursor mission profile are discussed. See also N70-31848. R.B.

N70-31848*# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
LARGE TELESCOPE EXPERIMENT PROGRAM (LTEP), VOLUME 1, PART 2
24 Apr. 1970 512 p refs
(Contract NAS8-21497)
(NASA-CR-102769; Rept-9800-Vol-1-Pt-2) Avail: CFSTI CSCL 17H

Summaries are given for optical technology experiments, superresolution and apodizing with segmented active optics, telescope thermal considerations, heat pipe feasibility, non-space experiments, image tubes, the Echelle spectrograph, the use of vidicons in astronomy, and current problems in infrared astronomy. See also N70-31847. R.B.

N70-31922*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESPONSE TESTS OF CUP, VANE, AND PROPELLER WIND SENSORS
Dennis W. Camp, Robert E. Turner, and Luke P. Gilchrist 18 May 1970 18 p refs
(NASA-TM-X-64522) Avail: CFSTI CSCL 20D

The results of a wind tunnel test program performed to investigate the response parameters of two types of cup anemometers, two types of wind vanes, and a propeller anemometer are presented. The distance constant for the cups (wind speed sensor) was found to be approximately 0.8 and 1.3 meters for the two types tested. Values for the damping ratio of approximately 0.48 and 0.40 were found for the two types of vanes. The main point of interest in the investigation of the propeller-type anemometer, other than its response, was how the indicated speed varied as a function of angle of attack. For an angle of attack (angle formed

by the longitudinal axis of the anemometer and the wind flow direction) within + or − 30 degrees into or away from the flow direction, a cosine curve would give a good approximation to the data. Author

N70-31954# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIVERSAL APPARATUS FOR DETERMINING THE DYNAMIC CHARACTERISTICS OF POLYMERS DURING PURE BENDING AND TORSION
S. K. Abramov et al 8 Jan. 1970 refs Transl. into ENGLISH from Tr. Inst. Inzh. Zhelezorudn. Transp. (Rostov-on-Don), no. 69, 1967 p 87–91
(AD-702982; FTD-HT-23-99-69) Avail: CFSTI CSCL 14/2

A short description is presented of an apparatus for determining the dynamic moduli of elasticity, the logarithmic decrement at large amplitudes of bending and torsional vibration, and the endurance limit of a material, all on the same polymer specimen. Dimensions of the specimen are: diameter 6 mm, length 60 mm. The apparatus operates on the basis of the resonance method of creating vibrations in the specimen and subsequently measuring automatically the amplitudes, frequency, and number of cycles of forced and free vibrations. Also presented are methods of determining dynamic characteristics with the apparatus. Author (TAB)

N70-31972# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF MEASURING AVERAGE VELOCITY RATE IN PIPES BY MEANS OF POINT-TYPE SENSORS
V M Kos et al 18 Sep. 1969 10 p refs Transl. into ENGLISH from Politekhn. Inst. Kontrolno-Izmeritelnaya Tekhn. (LVOV), no. 4, 1968, p 123–126
(AD-700368; FTD-HT-23-420-69) Avail: CFSTI CSCL 20/4

Assuming that the rates of flow are symmetrically distributed with respect to the pipe axis, the location of a layer is found in which the flow rate is equal to the average flow rate of the fluid in the pipe; the variation of this location with the varying average rate is investigated. Experimental curves of rate versus radius are shown. These curves are described by an exponential equation. Examination of this equation shows that the measurement of the average rate by a point-type sensor placed in the average-rate layer is much more accurate than the measurement of the maximum rate with subsequent rate correction. The theoretical error of measurement when the point sensor is displaced from its true average-layer position by 1 percent is 0.15 percent. However, the practical value of this error will be somewhat higher. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-30688# Joint Publications Research Service, Washington, D.C.
INNOVATIONS IN PNEUMONICS
21 Apr. 1970 20 p ref Transl. into ENGLISH from the book 'Novoye v Pnevmonike' Moscow, 1969 p 5–8, 28–36
(JPRS-50365) Avail: CFSTI

CONTENTS:

1. TEST FOR THE USE OF JET MODULES IN POSITIONING ARRANGEMENTS OF PROGRAMMED CONTROL OF METALCUTTING MACHINE TOOLS V. A. Leshchenko and Yu. S. Pochtar p 1–4 (See N70-30689 16-15)

2. JET DIGITAL REGULATOR M. L. Podgoyetskiy, B. S. Shkrabov, Ya. M. Mar'yanovskiy, and I. M. Pronin p 5–11 ref (See N70-30690 16-15)

3. POWER SUPPLY FOR JET CONTROL MECHANISMS E. G. Popov and G. A. Stepakov p 12–15 (See N70-30691 16-15)

N70-30689# Joint Publications Research Service, Washington, D.C.
TEST FOR THE USE OF JET MODULES IN POSITIONING ARRANGEMENTS OF PROGRAMMED CONTROL OF METALCUTTING MACHINE TOOLS
V. A. Leshchenko et al *In its* Innovations in Pneumonics 21 Apr. 1970 p 1–4 (See N70-30688 16-15)
Avail: CFSTI

A study was conducted on creating metal-cutting machine tools based on jet modules. A model was developed and tested of an eight-digit digital pneumohydraulic jet positioning arrangements of programmed control, which is a closed servo system; the conversion of the signal in the control circuits is accomplished by jet modules, and a hydraulic drive is used at the output. A diagram of the structural and principle scheme of the system is included. Author

N70-30690# Joint Publications Research Service, Washington, D.C.
JET DIGITAL REGULATOR
M. L. Podgoyeskiy et al *In its* Innovations in Pneumonics 21 Apr. 1970 p 5–11 ref (See N70-30688 16-15)
Avail: CFSTI

Results are presented for the creation of a digital system of proportional dosing of flotation agents based on using jet modules; the materials for testing the modules, the units and the device as a whole are also presented. The system was developed to regulate the relationship between the discharge in a continuous flow and the proportionally supplied agent. Author

N70-30691# Joint Publications Research Service, Washington, D.C.
POWER SUPPLY FOR JET CONTROL MECHANISMS
E. G. Popov et al *In its* Innovations in Pneumonics 21 Apr. 1970 p 12–15 (See N70-30688 16-15)
Avail: CFSTI

Requirements of power supply systems for jet control machines are outlined with tests for different power sources. Based on tests conducted, it was found that jet control devices are efficient in the closed contour using a centrifugal ventilator as the power source. J.M.C.

N70-30914# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ADVANCED LARGE OBJECT RECOVERY SYSTEM
J. A. Barker Dec. 1969 54 p
(AD-700901; LMSC-D025686) Avail: CFSTI CSCL 13/10

In 1969, the Advanced Large Object Recovery System (ALORS) successfully recovered a 4-ft dia x 15-ft long cylinder from the ocean bottom in 470 ft of water. The large object was recovered first by using Deep Quest to bring up the recovery module with the entrapped object, and then by having TransQuest hoist the module and object from the bottom after they were released from Deep Quest. The two recoveries climaxed a series of operations in which the technical and operational difficulties and obstacles associated with large object recovery were encountered and overcome, thereby providing a realistic design base for the development of large object recovery systems for other programs. This concludes the planned activity in large object recovery under the LMSC Independent Development Program. Author (TAB)

N70-30918*# Techtran Corp., Glen Burnie, Md.
EFFECT OF LUBRICATION FILM ON THE AXIAL RIGIDITY OF A HIGH-SPEED RADIAL THRUST BALL BEARING
I. A. Baranov and I. I. Nevzorov Washington Jun. 1970 6 p ref Transl. into ENGLISH from Priborostroenie (Moscow), v. 12, no. 6, 1969 p 72-75
(Contract NASw-2037)
(NASA-TT-F-12925) Avail: CFSTI CSCL 13I

An analysis is presented of the effect of a lubrication film located between the balls and the inner and outer races on the axial rigidity of a ball bearing as function of the axial load and rotational speed. Formulas for determining the axial rigidity of ball bearings caused by the lubrication film are derived. Author

N70-31037# Defense Documentation Center, Alexandria, Va.
FORGING, VOLUME 1 Report Bibliography, Apr. 1961 - Nov. 1969
Mar. 1970 99 p refs
(AD-702800; DDC-TAS-70-16-1) Avail: CFSTI CSCL 13/8

The bibliography is a compilation of annotated references on forging. References primarily deal with forging methods, materials, equipment and applications thereof. Computer-generated indexes for corporate author-monitoring agency, subject, and contract are included. Author (TAB)

N70-31047# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF CUTTING FLUIDS ON RESIDUAL STRESSES DURING FACE MILLING OF HEAT-RESISTANT ALLOY EI437B
V. M. Zaitsev et al 21 Oct. 1969 11 p ref Transl. into ENGLISH from Tr. Inst. Aviats. (Kuibyshev), no. 25, 1967 p 207-210
(AD-702979; FTD-MT-24-265-69) Avail: CFSTI CSCL 13/8

Results are given of a study of the influence of different types of cutting fluids and of their feed methods on the residual stresses during the face milling of the alloy EI 437B by an inserted-blade face mill with a single blade made of steel R965. A 7 percent emulsion with and without the addition of 2 percent sulfofrezol (petroleum oil mixed with sulfur) was used, feed being by ordinary slushing and atomization at a pressure of 2.5-3 atm. Emulsion flow in the first case amounted to 10-12 liters per minute and in the second case, 200-250 g per hr. Milling was also accomplished while cooling with a fog or spindle oil. Residual stresses were determined by the method of Academician N. N. Davidenkov. It was established that the use of the cutting fluids exerts a noticeable and very complex influence on the nature of the distribution of the residual stresses. The correct selection of cutting fluids can facilitate a decrease in tensile stresses and in the formation of compressive stresses. Low concentration oil-water emulsions and aqueous solutions of salts which possess cooling properties should be classified among those which facilitate a decrease in tensile stresses. Author (TAB)

N70-31162 National Lending Library for Science and Technology, Boston Spa (England).
FUNDAMENTAL STUDIES ON ADHESIVE AND ABRASIVE WEAR BY MEANS OF THE RADIOACTIVE MARKING METHOD
K. Wagner 1970 8 p Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 240, no. 5/6, 1969 p339-352
(NLL-RISLEY-Trans-1894-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The use of radioactive marking in friction, lubrication and wear is studied with copper and steel disks rotating under a loaded radioactively marked silver pin with a spherical end. Wear processes are listed as: adhesive, abrasive, corrosive, and fatigue. It is shown that it is impossible to clearly explain the action of one parameter without considering the other factors. The results are analyzed, and a series of questions are given in which radioactive marking investigations can play an important role in answering. F.O.S.

N70-31173 National Lending Library for Science and Technology, Boston Spa (England).
INTRODUCTION OF CONTINUOUS PROCESSES IN NICKEL PRODUCTION
V. Y. Poznyakov 20 Apr. 1970 12 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), v. 42, no. 10, 1969 p 20-25 In ENGLISH and RUSSIAN
(NLL-Trans-746-470-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The advantages of continuous processes and recent innovations in nickel production are summarized. Preliminary results of introduction of continuous techniques show a decrease in losses, an increase in the productivity of roasting furnaces, a more uniform system of work in the plant, and a decrease in fuel costs with a corresponding improvement in work conditions. R.B.

N70-31217# Sandia Corp., Albuquerque, N.Mex. Photochemical Lab.
QUICK, LOW-COST DEVELOPMENT TOOLING AND PARTS FROM PHOTOPOLYMER
T. A. Allen Mar. 1970 31 p refs Sponsored by AEC
(SC-DR-70-59) Avail: CFSTI

Photopolymer material, a photosensitive plastic which may be optically formed, can produce intricate precise three-dimensional configurations quickly and economically by photographic principles. Its characteristics, processing requirements, and some of its applications in development-shop support of engineering activities are described. Author (NSA)

N70-31275# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
AIR-BEARING STEADY REST FOR PRODUCTION MACHINE TOOLS
P. J. Steger and M. L. Sheil 25 Mar. 1970 18 p refs
(Contract W-7405-eng-26)
(Y-SC-4) Avail: CFSTI

Two types of air-bearing steady rests were designed and fabricated. The first type is a noncaptive, adjustable-pad arrangement with graphite liners and a spherical seat support; the second type is a captive system consisting of four equally spaced and adjustable pads supported by spherical seats. These steady rests eliminated chip fouling, which was a problem with the roller-bearing steady rests, and also improved the thermal stability and reduced the vibration resulting from high surface speeds. Author

N70-31306# South Carolina Univ., Columbia. Coll. of Engineering.
POWDER METALLURGY COMPACTION Quarterly Progress Report, 1 Dec. 1969 - 28 Feb. 1970
E. G. Schwartz, Kenneth L. Wilson, and James B. Hornsby 28 Feb. 1970 18 p refs
(Contract AT(38-1)-475)
(SRO-475-5) Avail: CFSTI

Activities in programs to establish a lubricant spraying system and to investigate the effects of axial die movement during powder compaction are reported. Details of work on die lubrication are given along with results of studies on die movements. NSA

N70-31377# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
A TOPOLOGICAL STUDY OF THE SINTERING PROCESS Final Report, Jun. 1959-May 1969
F. N. Rhines, R. T. De Hoff, and J. Kronsbein Dec. 1969 165 p refs
Dec. 1969 165 p refs
(TID-25376) Avail: CFSTI

Topological, Euclidean, and physical parameters are identified, which must be specified in order to be able to predict the course of a sintering sequence, and the interrelations among these parameters that define the rate of sintering are established so that sintered materials and the procedures for making them may be formulated by deliberate design. The studies show that it is necessary to quantitatively determine the evolution of structure in real, three dimensional aggregates of powder particles. Author

N70-31490# Franklin Inst., Philadelphia, Pa. Research Labs.
A REVIEW OF RESEARCH IN THE FIELD OF GAS-LUBRICATED BEARINGS Interim Report
Dudley D. Fuller Mar. 1970 71 p refs
(Contract Nonr-2342(00))
(AD-703648; I-C2429-2) Avail: CFSTI

The review covers results of research in a spectrum of gas-bearing configurations, applications of gas bearings in various use categories, and future prospects. Author (TAB)

N70-31611# Defense Documentation Center, Alexandria, Va.
ELECTROPLATING, VOLUME 1 A DDC Bibliography, Oct. 1964 - Mar. 1969
(AD-703700; DDC-TAS-70-27-1) Avail: CFSTI CSCL 13/8

The bibliography contains references to reports on the process of coating metals and composites by the electroplating technique. The computer-generated indexes are Corporate Author-Monitoring Agency and Personal Author. Author (TAB)

N70-31646# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROLYTE USED IN ELECTROCHEMICAL PROCESSING
Kuei-Neng Pan et al 31 Dec. 1969 9 p refs Transl. into ENGLISH from Shang-Hai Chi-Hsieh (Shanghai), no. 8, 1964 p 29-30
(AD-704055; FTD-HT-23-531-69) Avail: CFSTI CSCL 11/6

Electrolytes used in electrochemical processing of metals are briefly discussed. TAB

N70-31764# Union Carbide Corp., San Diego, Calif. Crystal Products Dept.
MANUFACTURING PROCESS FOR LARGE SHEETS OF TRANSPARENT SINGLE CRYSTAL ALUMINUM OXIDE BY THE CZOCHRALSKI METHOD Interim Report, Apr.-Jul. 1969
G. A. Kreig and J. M. J. Watt Watertown, Mass. AMMRC 30 Mar. 1969 21 p
(Contract DAAG46-69-C-0002)
(AD-702931; AMMRC-CR-69-20/2; IR-2) Avail: CFSTI CSCL 20/2

The process for the growth of single crystal aluminum oxide plate has been further developed to obtain more reproducible results. Particular emphasis has been placed on improvement of crystalline shape, and optical quality. The initial plate dimensions were 4 inches x 8 inches x 3/8 inches thick; this has been extended to 4 inches x 8 inches x 3/8 inches thick through the use of a large size seed crystal. The problems of fabricating the large size plates have been considered and some development work carried out. Some initial work has been carried out to develop a furnace for the growth of large size crystals with dimensions 8 inches x 8 inches x 1/2 inches thick. Author (TAB)

N70-31765# Union Carbide Corp., San Diego, Calif. Crystal Products Dept.
MANUFACTURING PROCESS FOR LARGE SHEETS OF TRANSPARENT SINGLE CRYSTAL ALUMINUM OXIDE FOR THE CZOCHRALSKI METHOD Interim Report, Jan.-Apr. 1969
G. A. Krieg and J. M. J. Watt Watertown, Mass. AMMRC 31 Jan. 1969 14 p
(Contract DAAG46-69-C-0002)
(AD-702930; AMMRC-CR-69-20/1; IR-1) Avail: CFSTI CSCL 20/2

The Czochralski technique has been developed for growth of single Al2O3 in plate form for transparent armor application. A description of the growth process is given along with the development work carried out prior to issuance of the contract. Scale-up has been carried out to produce a single crystal plate with dimensions in the as-grown state of 4 inches x 6 inches x 3/8 inches thick. The problems of furnace design and power control for the larger size growth unit is described along with a preliminary amount of the optical quality. Author (TAB)

N70-31766# Union Carbide Corp., San Diego, Calif. Crystal Products Dept.
MANUFACTURING PROCESS FOR LARGE SHEETS OF TRANSPARENT SINGLE CRYSTAL ALUMINUM OXIDE BY THE CZOCHRALSKI METHOD Interim Report, Jul.-Oct. 1969
G. A. Kreig and J. M. J. Wales Watertown, Mass. AMMRC 31 Aug. 1969 18 p
(Contract DAAG46-69-C-0002)
(AD-702932; AMMRC-CR-69-20/3; IR-3) Avail: CFSTI CSCL 20/2

Work has continued to develop the Czochralski process for the growth of high crystal alumina oxide in plate for M. More emphasis has been placed during the third quarter in the development of the large size furnace. This transaction to the larger size has introduced a number of fabrication work was carried out to develop a suitable technique for grinding and polishing the large plates. Author (TAB)

N70-31777# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL-EXPERIMENTAL METHOD OF DETERMINING THE COEFFICIENT OF FRICTION ON THE LEADING SURFACE
M. A. Aranzon 8 Jan. 1970 13 p refs Transl. into ENGLISH Tr. Kubyshevsk. Aviats. Inst. (Kuibyshev), no. 25, 1967 p 81-93
(AD-702850; FTD-MT-24-335-69) Avail: CFSTI CSCL 13/9

The friction coefficient of the leading face of a tool is one of the more important factors which reflect processes occurring in the zone where chips are formed and come in contact with the tool. Thus, the effects which indicate external conditions of cutting (rate and depth of cut, etc.) as related to the friction coefficient must be studied for their influence on the formation of chips and their contact phenomena. Dependence of the friction coefficient on basic physical and technological parameters of the cutting process is determined by a theoretical equation for the maximum temperature for tool face contact. Author (TAB)

N70-31804*# Virginia Univ., Charlottesville. Dept. of Mechanical Engineering.
TRANSIENT JOURNAL BEARING ANALYSIS
R. Gordon Kirk and Edgar J. Gunter, Jr. Washington NASA Jun. 1970 210 p refs
(Grant NGR-47-005-050)
(NASA-CR-1549) Avail: CFSTI CSCL 13I

The transient response of a nonlinear fluid film journal bearing is obtained by numerical methods of integration, utilizing a modern, high-speed digital computer and its component automatic plotting unit. An expression for the pressure in the fluid film of a short journal bearing is derived and the three-dimensional plots of the resulting pressure surface are presented for selected conditions. The

transient orbit of the journal center is automatically plotted as a point moving in a unit clearance circle. The results show the effect of unbalance, steady loading, cyclic unidirectional and rotating loads upon the stability and performance of a short journal bearing. The results are compared to previous investigations and modified stability maps are deduced from the results obtained. The concept of whirl is examined and several plots presented of the instantaneous whirl and radius of curvature against cycles of motion for the various cases considered. Bearing forces are analyzed and the resulting plots of force against cycles of motion are presented for selected cases. Author

N70-31810# Defense Documentation Center, Alexandria, Va.
SPUTTERING, VOLUME 1 Report Bibliography, May 1962 - Oct. 1969
Apr. 1970 158 p refs
(AD-703900; DDC-TAS-70-29-1-Vol-1) Avail: CFSTI CSCL 13/8

The annotated references primarily deal with sputtering techniques and applications. Computer-generated indexes of Corporate Author-Monitoring Agency, Subject, and Contract are provided. Author (TAB)

N70-31838# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WELDING: A NEW ELEMENT OF ASTRONAUTICS
V. G. Fartushnyi et al 23 Jan. 1970 5 p Transl. into ENGLISH from Sovetskaya Rossiya (USSR), 15 Oct. 1969 p 2
(AD-704039; FTD-HT-23-608-69) Avail: CFSTI CSCL 13/8

The article discusses welding under the high vacuum and weightlessness conditions of outer space. It briefly summarizes the advantages of welding over other joining methods in outer space. TAB

N70-31850# Defense Documentation Center, Alexandria, Va.
ELECTRODEPOSITION, VOLUME 1 Report Bibliography, Oct. 1954 - Aug. 1969
Mar. 1970 205 p refs
(AD-703800; DDC-TAS-70-30-1-Vol-1) Avail: CFSTI CSCL 13/8

The document is Volume 1 of a two-volume bibliography on Electrodeposition. It contains unclassified and unlimited references. Author (TAB)

N70-31925*# Monsanto Research Corp., Dayton, Ohio.
PROCESSING, APPLICATION, AND EVALUATION OF SEALANTS FOR FUEL TANKS IN ADVANCED AEROSPACE STRUCTURES Quarterly Progress Report, 1 Mar. - 31 May 1970
Samuel Steingiser, George L. Hanna, and Edward A. Steinmetz 15 Jun. 1970 49 p
(Contract NAS8-21399)
(NASA-CR-102754; QPR-6) Avail: CFSTI CSCL 11A

Infrared spectrographic and thermal gravimetric analyses revealed sealant degradation products, but good thermal stability and oxidative resistance for the Viton and fluorosilicone sealants. No degradation products were detected from the polyimide sealants but their degradation temperatures are approximately 150 to 200 F lower than for the Viton or fluorosilicone. After 1000 hours of exposure the fluorosilicone and two polyimide sealants had not induced stress corrosion cracking, however, five tensile bars coated with the Viton sealant all failed by stress corrosion within 400 hours, even with pretreating for removal of corrosion causing HF-amine salt. The 500 F exposure environments were too severe for the two polyimide sealants, but the MANE 482 Viton sealant satisfactorily withstood all three tests. The DOW fluorosilicone sealant satisfactorily withstood the 500 F air exposure, but was severly degraded by 500 F fuel vapor exposures. The two primers evaluated provided similar levels of sealant adhesion, which were adequate. A HF acid pickle did not produce a noticeable increase in sealant adhesion over the MIBK solvent treatment. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-30913*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A PROGRAMMED MULTIPULSE RANGE MEASUREMENT SYSTEM
S. K. Poultney [1970] 6 p refs
(Grant NGR-21-002-109; Contract DAHC04-67-C-0023)
(NASA-CR-110450) Avail: CFSTI CSCL 20E

Problems that arise in practice due to the nature of the laser transmitter are discussed in terms of short term temperature changes in the laser rod during the pump cycle which affect the wavelength of the output pulse. Cavity mirrors, wavelengths, pulse widths for Q-switched lasers are also discussed. It is concluded that the multipulse measurement system of Ackerman is practical if sufficient care is given to the laser design and range-timing start pulse. F.O.S.

N70-31030*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
LASER TRACKING AND RANGING SYSTEM Final Report
15 Jan. 1969 98 p
(Contract NAS9-7482)
(NASA-CR-92485; AED-R-3388) Avail: CFSTI CSCL 17H

Development and testing of the engineering model of a Laser Tracking and Ranging System (LTRS) are discussed. The LTRS is an optical tracking radar using a gallium-arsenide injection laser as the transmitting source. The system is designed to track a small retrodirective corner-reflector array and to provide continuously the range, azimuth, and elevation of the array's position relative to the tracking unit. Development effort has been directed toward providing a small, compact and relatively lightweight instrument mainly as part of the Lunar Surveying System for tracking an astronaut's staff. Other possible applications include the LTRS as a navigation instrument for a Lunar Flying Vehicle and as a crew safety device for monitoring an astronaut's situation during EVA operations. The development project was successful with operational performance meeting all required specifications. Tracking of a retroreflector target from 12 to 700 meters was demonstrated with azimuth and elevation angular accuracies of + or - 1 milliradian and a range accuracy of + or - 1.0 meter. A.L.

N70-31032# Catholic Univ. of America, Washington, D.C.
LASER-INDUCED INSTABILITIES IN GASES. THERMALLY INDUCED MODIFICATIONS OF A HIGH POWER CW LASER BEAM Interim Report, 31 Oct. 1968 - 1 Nov. 1969
P. M. Livingston 1 Nov. 1969 49 p refs
(Contract DAHC-04-68-C-0045)
(AD-703009; AROD-7755-1-P; IR-2) Avail: CFSTI CSCL 20/6

The problem of beam induced thermal modifications of a high-powered CW laser beam is considered. The extent and type of modification depend principally upon the nature of the medium (liquid or air), and whether an external flow field is present. These conditions determine the dominant heat loss mechanism operating in the fluid; forced convection, free convection, and diffusion, and thus the beam distortions. All three cases are analysed and figures presented, showing the type of distortion expected as determined within the framework of geometric optics. Author (TAB)

N70-31073*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
LASER BEAM POINTING TESTS
C. O. Alley and D. G. Currie Jun. 1968 10 p refs
(Grant NGR-21-002-109)
(NASA-CR-110449; TR-885) Avail: CFSTI CSCL 20E

The ability of earth stations for directing very narrow laser beams to a specific location on the lunar surface was provided by the detection sensitivity of the Surveyor 7 vidicon camera operating in its integration mode. Six transmitting stations were established; each consisted of an argon-ion laser with a suitable optical system for collimating and aiming the laser beam. All six stations used the technique of directing the laser beam backward through a telescope to reduce the beam divergence. However, each station used a different method for aiming the laser beam. By combining the laser observations with the planned earth light polarization, it was possible to increase the length of the observing periods of the lunar surface. The primary value of these tests lies in the experience gained in a variety of techniques for tracking and pointing laser beams with different types of telescopes. The potential value of well collimated laser beams for space communications is emphasized by noting that the 1-W laser beams appeared as bright stars, while the uncollimated light from major cities was not detected. E.M.C.

N70-31273# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
LASER-INDUCED EMISSION OF STRONG ELECTRON PULSES IN THE NANOSECOND RANGE
G. Siller, K. Buechl, and E. Buchelt Jun. 1969 25 p refs
(IPP-0/2; IPP-3/100) Avail: CFSTI

The light of a Q-switched ruby laser (2.5 joule, 17 nsec) was focused on a tantalum target and strong electron pulses of up to one kiloampere were extracted from the surface. The pulse length in the nanosecond range was determined by the length of a delay line used as voltage source for the extracting voltage. The charge carriers in the negative pulse were identified as being free electrons. Author (ESRO)

N70-31339# United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH INVESTIGATION OF PICOSECOND LASER PULSES Annual Report, 1 Mar. 1969 - 28 Feb. 1970
Anthony J. DeMaria, William H. Glenn, Carl M. Ferrar, George L. Lamb, Jr., and Michael E. Mack 26 Mar. 1970 160 p refs
(Contract N00014-66-C-0344; ARPA Order 306A-15)
(AD-703668; UACRL-J920479-29) Avail: CFSTI CSCL 20/5

Topics discussed include theoretical and experimental work made on the propagation of ultrashort light pulses, stimulated scattering effects, nonlinear propagation, Cerenkov radiation, organic dye lasers, and stimulated emission from laser produced plasmas. Author (TAB)

N70-31348# Naval Research Lab., Washington, D.C. Electron Physics Branch.
SEALED-OFF CO2 LASER DISCHARGE PARAMETER STUDY Interim Report
Wayne T. Whitney and Myron A. Shear 11 Feb. 1970 30 p refs
(AD-703618; NRL-7017) Avail: CFSTI CSCL 20/5

The report presents experimental data on the output power and efficiency of the sealed-off CO2 laser as a function of discharge current, the initial fill pressures of CO2 and He, and the tube diameter. The optimum fill pressure of pure CO2 for maximum power output and efficiency was found to be approximately 5/d Torr, where d is the tube diameter expressed in cm. At this pressure the optimum current for maximum power output was about 7d mA. The output power can be increased by a factor of five with the addition of about 10 Torr of He. With He, the optimum current for maximum power output was approximately 18d mA. Author (TAB)

N70-31360# European Space Research Inst., Frascati (Italy).
IONISATION IN A LASER PRODUCED PLASMA
T. S. Green Apr. 1970 8 p refs
(ESRIN-IN-82) Avail: CFSTI

An estimate was made of the ionization level attained in a laser-produced plasma, and therefore of the energy loss to ionization. It is shown that in general the loss is small though not negligible and will not significantly change the dependence of temperature on laser power. Author (ESRO)

N70-31392# European Space Research Inst., Frascati (Italy).
EVOLUTION OF THE FOG DROPLET SIZE DISTRIBUTION OBSERVED BY LASER SCATTERING
R. Ferrara (CNR, Rome), G. Fiocco, and G. Tonna (CNR, Rome) Mar. 1970 20 p refs Submitted for publication
(ESRIN-IN-77) Avail: CFSTI

Scattering of a continuous wave He-Ne laser beam in artificial fog was observed by five photometers at different angles. The intensity of the light scattered in the different directions was related to a gamma-type spectral distribution of the droplet sizes. The artificial fog was produced in a 40 cu m chamber where the main physical parameters (vapor and nuclei concentration, temperature) could be controlled to reproduce the complete evolution process. The fog droplet size spectrum was determined at intervals of about one minute. Author (ESRO)

N70-31484# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSE WITH MATERIALS Quarterly Technical Report, 18 Dec. 1969 - 18 Mar. 1970
Chi H. Lee 18 Mar. 1970 12 p refs
(Grant DA-ARO/D1-31-124-G50; ARPA Order 675-7)
(AD-704365) Avail: CFSTI CSCL 20/12

The project covers the general subject of the interaction of the picosecond pulses with matter. Among the specific tasks proposed are the study of the optical harmonic generation with picrosecond pulses and the measurement of the short pulses with nonlinear method. Author (TAB)

N70-31561# Naval Research Lab., Washington, D.C.
TRANSIENT RADIATION EFFECTS ON RUBY LASERS Final Report
Richard F. Wenzel, Joseph J. Halpin, Francis J. Campbell 20 Feb. 1970 96 p refs
(AD-704069; NRL-7063) Avail: CFSTI CSCL 20/5

The report describes ionizing radiation effects on a ruby laser. Both transient and permanent radiation effects are discussed. The transient cut-off observed in a ruby laser when irradiated is attributed to a transient optical absorption center associated with a O(-) ion trapped at a charge deficient cation site in the Al2O3 lattice. The center has a lifetime of about 10 msec at room temperature. The permanent radiation effects are a reduction of or cessation of laser output. This effect has three causes, color center formation in the pump bands, loss of Cr(3+) by valence change, and a permanent absorption at the R lines. The important effect at the level of 10,000 rad (ruby) is color center formation in the pump bands. A worse case estimate is, ignoring flash lamp bleaching, for a 0.05% Cr(3+), 0.25 inch. diam. rod of 60 deg orientation, (a typical ruby laser rod), that a dose of 10,000 rad (ruby) will reduce the optical pumping by 10%. This means that 10,000 rad (ruby) will shut off a laser operating at 110% threshold. The defects producing the color centers are isolated, remotely charge

compensated defects in the lattice. Locally charge compensated defects which involve a Cr(3+) ion are also observed and account for most of the Cr(3+) loss on irradiation. The maximum Cr(3+) loss observed, independent of concentration was 10%. Author (TAB)

N70-31750# Naval Research Lab., Washington, D.C.
ATMOSPHERIC PROPAGATION WITH THERMAL BLOOMING
J. W. Tucker and R. N. De Witt 31 Dec. 1969 23 p refs
(AD-703213; NRL-7038) Avail: CFSTI CSCL 20/6

Thermal blooming of a laser beam is described by a model equation for the trajectory of a selected profile ray. The model equation is applied to an examination of optical focusing for increasing transmitted power density. It is shown that the model equation is asymptotic in the far field to the geometric far field solution based on Snells law for a stratified medium. Author (TAB)

N70-31876# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Lab.
LASER MODE COUPLING PRODUCED BY SUBMULTIPLE AXIAL MODE INTERVAL MODULATION OF THE OPTICAL CAVITY LENGTH
Albert L. Pardue, Jr. 24 Nov. 1969 20 p refs
(AD-703880; RR-TR-69-20) Avail: CFSTI CSCL 20/5

The report presents an analysis of laser mode coupling produced by moving one of the cavity reflectors at a frequency less than the quiescent axial mode interval. It is found that mode coupling results when the modulation frequency is a submultiple of the quiescent axial mode interval. Mode coupling by cavity-length modulation in lieu of phase or loss modulation eliminates the necessity of inserting elements within the laser cavity. Mode coupling by means of mirror motion is particularly advantageous at optical frequencies where low-loss electro-optic or acoustic diffraction materials are unavailable. Mode coupling at submultiples of the quiescent axial mode interval would be more physically realizable than c/2L mode locking because of the greater mirror excursions allowable. Author (TAB)

N70-31886# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
PRELIMINARY PERFORMANCE OF A CW CHEMICAL LASER, MAY–OCTOBER 1969
Donald J. Spencer, Harold Mirels, Theodore A. Jacobs, and Rolf W. F. Gross 30 Nov. 1969 14 p refs
(Contract F04701-69-C-0066)
(AD-704118; TR-0066(5756-01)-1; SAMSO-TR-70-113) Avail: CFSTI CSCL 20/5

Preliminary performance of a CW chemical laser is presented. Hydrogen is diffused into a supersonic stream containing F atoms. Population inversion is due to the reaction H2 + F yields HF(v) + H, Delta H = -31.7 kcal/mol, v = 1,2. An atomic F flow rate of 0.030 moles/sec has produced 475 W of laser power. This represents 12% of the chemical energy involved in the above reaction. Zero power gain is 8%/cm. Spectroscopic observations of laser transitions are included. Author (TAB)

N70-31907# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
SELF-GIANT-PULSED OPERATION OF RUBY AND Nd(3+):YAG LASERS, JANUARY 1968–DECEMBER 1969
Milton Birnbaum 14 Feb. 1970 27 p refs
(Contract F04701-69-C-0066)
(AD-703714; TR-0066(9230-11)-1; SAMSO-TR-70-120) Avail: CFSTI CSCL 20/5

Self-giant-pulsed operation of ruby lasers at 77 and 300K and Nd(3+):YAG lasers at 77K pumped by the 5145A output of a pulsed argon ion laser is described. Self-giant-pulsed operation was obtained by: (1) static mirror misalignment, and (2) static misalignment of the filament of the pumped laser material with respect to the mirror resonator axis. An output that consisted of a single giant pulse could be obtained for ruby by either method; for Nd(3+):YAG, the output always consisted of one or more giant pulses and characteristic relaxation oscillations. These results are compared with the predictions of the theoretical model of E. R. Peressini in which the self-giant pulsing of these lasers is described as a limiting case of spiking. The relaxation oscillations in the output of ruby, Nd(3+):YAG, Nd(3+): glass and Nd(3+):CaWO4 are compared with the theoretical predictions. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-30601# Michigan Univ., Ann Arbor.
THE INFLUENCE OF MOLYBDENUM ON THE GAMMA PHASE FORMED IN A SYSTEMATIC SERIES OF EXPERIMENTAL NICKEL-BASE SUPERALLOYS
Warren Tuttle Loomis (Ph.D. Thesis) Univ. Microfilms, Inc. 1969 96 p refs Sponsored by the Climax Molybdenum Co. of Mich.
Avail: Univ. Microfilms Order No. 70-4132

A systematic series of experimental alloys was prepared, based on a nickel content of about 75 atomic percent, a chromium content of about 15 atomic percent, and an aluminum content of 12 atomic percent. The influence of molybdenum additions to the alloys on the gamma' weight fraction, chemical composition, lattice parameter, and morphology was determined by making measurements on the gamma' phase that had been extracted from the two-phase alloys. The gamma' weight fraction was determined by weighing, as well as by performing a mass balance on the aluminum. Other techniques of analyses used were atomic absorption analysis, X-ray diffraction, and electron microscopy. Results indicate that molybdenum influences all of the important gamma' characteristics measured. Author

N70-30661# Batelle Memorial Inst., Columbus, Ohio.
PEIERLS-BARRIER THEORY Final Report
Robert H. Hobart 2 Mar. 1970 5 p refs
(Grant AF-AFOSR-1534-68)
(AD-702855; AFOSR-70-0667TR) Avail: CFSTI CSCL 20/12

The research accomplishments of a two year study of the Peierls-barrier are reported. Metals deform plastically principally by movement of dislocations and the Peierls-barrier is one of the impediments to such motion. Earlier work had indicated that the Peierls-barrier depends mainly on three parameters. The present work shows that these reduce to two parameters which are so closely related as to constitute a single complex parameter, a complex width where the real part is ordinary width and the imaginary part is the separation of partials if the dislocation is dissociated. Author (TAB)

N70-30666# Wisconsin Univ., Madison.
[ON NICKEL-ALUMINUM ALLOYS] Progress Report, Jan. 1969–Jan. 1970
Jan. 1970 11 p
(Contract AT(11-1)-1489)
(COO-1489-8; PR-5) Avail: CFSTI

During the present reporting period the work on CoAl and beta-brass was completed and presented for publication. The NiAl research is discussed. Author

N70-30670*# Tyco Labs., Inc., Waltham, Mass.
STUDY OF THE GENERAL MECHANISM OF STRESS CORROSION OF ALUMINUM ALLOYS AND DEVELOPMENT OF TECHNIQUES FOR ITS DETECTION Final Report, 1 Jun. 1966 - 1 Jun. 1969
S. B. Brummer, R. O. Bell, F. H. Cocks, and A. Cordellos Sep. 1969 330 p refs
(Contract NAS8-20297)
(NASA-CR-102693) Avail: CFSTI CSCL 11F

CONTENTS:
1. METALLURGICAL CHARACTERIZATION OF ALUMINUM ALLOYS p 3 - 16 (See N70-30671 16-17)
2. CORROSION AND STRESS CORROSION OF ALUMINUM ALLOYS p 17 - 118 (See N70-30672 16-17)
3. NONDESCRUCTIVE TESTING TECHNIQUES FOR THE DETECTION OF STRESS CORROSION p 119 - 269 (See N70-30673 16-17)
4. INVESTIGATION OF SURFACE RAYLEIGH WAVE RESPONSE WITH SIMULATED DEFECTS, APPENDIX 34 p (See N70-30674 16-17)

N70-30671*# Tyco Labs., Inc., Waltham, Mass.
METALLURGICAL CHARACTERIZATION OF ALUMINUM ALLOYS
In its Study of the Gen. Mech. of Stress Corrosion of Aluminum Alloys and Develop. of Tech. for its Detection Sep. 1969 p 3 - 16 (See N70-30670 16-17)
Avail: CFSTI CSCL 11F

The metallurgical characterization of both high purity and commercial Al alloys was undertaken to provide metallurgical information which can be correlated with the results of stress corrosion tests. Although the importance of metallurgical treatment and condition on the susceptibility of Al alloys is well known, the underlying reasons for this sensitivity are not yet completely understood. For commercial materials, the aim was to correlate susceptibility with the dislocation structure determined from the mechanical tests. For high purity materials, the goal was to correlate corrosive attack and mode of mechanical deformation with specific structures developed during aging. Author

N70-30672*# Tyco Labs., Inc., Waltham, Mass.
CORROSION AND STRESS CORROSION OF ALUMINUM ALLOYS
In its Study of the Gen. Mech. of Stress Corrosion of Aluminum Alloys and Develop. of Tech. for its Detection Sep. 1969 p 17 - 118 (See N70-30670 16-17)
Avail: CFSTI CSCL 11F

The results of an investigation to determine the complex interaction between mechanical and electrochemical factors in the corrosion behavior of aluminum alloys is presented. Polarization curve determinations via the potentiostatic method, weight loss studies, and galvanostatic anodizations were conducted at constant temperature, in an oxygen free environment, using high purity reagents. Emphasis of the investigation involved determining the polarization behavior in both 1M NaCl and 1M Na2SO4 using the potentiostatic method. In most cases, the cathodic as well as anodic polarization behavior was characterized. These characterization data are summarized and curves of the anodic and cathodic polarization are presented. D.L.G.

N70-30673*# Tyco Labs., Inc., Waltham, Mass.
NONDESTRUCTIVE TESTING TECHNIQUES FOR THE DETECTION OF STRESS CORROSION
In its Study of the Gen. Mech. of Stress Corrosion of Aluminum Alloys and Develop. of Tech. for its Detection Sep. 1969 p 119 - 269 (See N70-30670 16-17)
Avail: CFSTI CSCL 11F

A literature survey of available techniques is summarized. Detection methods are described using eddy currents and by the use of ultrasonic surface waves. The general principles involved with these methods and the experimental procedures for detection of stress corrosion cracking in aluminum alloys are outlined. The results of tests using ultrasonic surface waves are presented along with discussions of their significance. A section dealing with the instrumental design parameters for stress corrosion cracking detection is included. D.L.G.

N70-30674*# Tyco Labs., Inc., Waltham, Mass.
INVESTIGATION OF SURFACE RAYLEIGH WAVE RESPONSE WITH SIMULATED DEFECTS
In its Study of the Gen. Mech. of Stress Corrosion of Aluminum Alloys and Develop. of Tech. for its Detection Sep. 1969 34 p (See N70-30670 16-17)
Avail: CFSTI CSCL 11F

To determine the effect of surface defects on the propagation of Rayleigh waves, real defects such as cracks and pits were approximated as isolated artificial defects of known geometry. Cracks were simulated by grooves, and pits by hemispherical indentations or cylindrical holes with their axes perpendicular to the surface. Isolated U-shaped grooves were used as a first approximation to stress corrosion cracks. The measuring frequency of the sound was 4 MHz. U-shaped grooves of varying width and depth, and with a length longer than the width of the transducer crystal to avoid end effects, were cut on flat surfaces of 7075. The direction of propagation of the Rayleigh waves was perpendicular to the grooves and parallel to the rolling direction. Author

N70-30795*# Radio Corp. of America, Princeton, N.J.
EFFECT OF FERMI LEVEL MOTION ON NORMAL STATE PROPERTIES OF beta-TUNGSTEN SUPERCONDUCTORS
R. W. Cohen, G. D. Cody, and J. J. Halloran *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 26 - 33 refs Submitted for publication (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

A simple model of the electronic density of states is presented which yields, with the choice of essentially one parameter for Nb3Sn, excellent agreement with the observed temperature dependence of not only the paramagnetic susceptibility and the elastic constant C11-C12, but the electrical resistivity and the elastic constant C11. Furthermore the temperature dependences of the susceptibility for V3Si and V3Ga are correctly predicted. The model emphasizes the crucial aspect of a sharp drop in the density of states near the Fermi level, while it yields simple, manageable expressions for the experimental quantities. Author

N70-30915# National Materials Advisory Board, Washington, D.C.
TRENDS IN USAGE OF CADMIUM
Nov. 1969 27 p
(AD-700744; NMAB-255) Avail: CFSTI CSCL 11/6

The report is an analysis of the consumption of cadmium in the United States by individual end uses. It was determined that electroplating accounts for roughly 50% of the total consumption. Over the past several years, a new use of cadmium as a constituent in stabilizers for polyvinyl chloride has become of importance, accounting for roughly 20% of consumption, and is increasing. Pigment consumption remains high and it also accounts for approximately 20% of consumption. Most of the remaining cadmium is used in batteries and various metallurgical applications. Several general conclusions concerning the production and consumption pattern are possible. First, cadmium is a by-product of zinc production, which is only slowly growing, and therefore the supply

of cadmium is not very elastic. Second, the uses of cadmium are varied and except for electroplating, the cost of cadmium is a small to modest fraction of the total cost of the end item, therefore, large areas of demand are not closely coupled to cost and as a consequence, modest changes in demand for even a single end use could have a profound impact on the cost of the metal. Third, as a metal used in small amounts in numerous applications, its consumption pattern is subject to changing technology and therefore, forecasting changes in the type of a consumption pattern for long periods of time is hazardous, if not impossible. Author (TAB)

N70-31018# British Steel Corp., London (England). Metallurgy Div.

FRACTURE TOUGHNESS TESTING IN IMPACT

A. H. Priest and M. J. May 1969 27 p refs

(MG/C/46/69) Avail: CFSTI

The measurement of plane strain fracture toughness (K sub Ic) is dealt with in impact tests where inertial load effects influence load measurements derived from instrumentation of the tup and anvil of the testing machine. Load measurements were determined using post yield strain gages attached across the specimen notch and it was found that the load on the specimen during the impact test is a simple function of the compliance of the specimen, the test machine and the impact velocity. In order to calculate the fracture load it was necessary to determine accurately the instant at which fracture initiated, this was possible by monitoring voltage changes occurring in the plastic zone at the crack tip. Impact K sub Ic values calculated from the fracture load show good reproducibility and are in good agreement with K sub Ic values extrapolated from tests performed at lower strain rates. Author

N70-31019# British Steel Corp., London (England). Metallurgy Div.

THE EFFECT OF POSITION OF MEASUREMENT ON CRACK OPENING DISPLACEMENT

D. Elliott and M. J. May 1969 12 p refs

(MG/C/47/69) Avail: CFSTI

The need is emphasized for an experimental method of obtaining the crack tip crack opening displacement from measurements made remote from the crack tip location. A method is described whereby clip gage displacements can be converted to the crack tip crack opening displacement from a prior knowledge of the displacement magnification and rotational effects for specimens of different notch depths. The effects of crack extension and the influence of triaxial stresses are also discussed. Author

N70-31022 National Lending Library for Science and Technology, Boston Spa (England).

INVESTIGATION OF PHASE EQUILIBRIA OF CRYSTALLINE STRUCTURES OF COMPOUNDS IN Ti-Fe(CO,NI)-Si SYSTEMS

V. Y. Markiv et al 20 Apr. 1970 18 p refs Transl. into ENGLISH from Diagrammy Sostoyania Metallicheskikh Sistem, Akad. Nauk SSSR (Moscow), 1968 p 137-145

(NLL-Trans-746-516-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl. .2 NLL photocopy coupons

The phase equilibrium and crystal structure of compounds as studied in the Ti-X-Si system, where X is Fe, Co, or Ni. The preparation of the alloys is described. The results of the X-ray and microstructural analysis show that in the Ti-Fe-Si system, five ternary compounds are formed: TiFeSi2, TiFe10Si44, Ti45Fe15Si40, Ti12Fe52Si3, and TiFeSi. The compounds for the Ti-Co-Si, and Ti-Ni-Si systems are also given. An analysis of the crystal structure of the ternary compounds formed in these systems is included. F.O.S.

N70-31043# Boeing Co., Renton, Wash. Commercial Airplane Div.

EVALUATION OF CARPENTER PYROMET X-15

Jack M. Uchida 20 Nov. 1969 25 p refs

(AD-700912; D6-23929) Avail: CFSTI CSCL 11/6

Pyromet X-15 is a high-strength precipitation hardening stainless steel which can be heat treated to 240 ksi. The mechanical properties of the 240 ksi level is good but the fracture toughness is very low. The smooth fatigue life is comparable to other steels at the same strength level. The stress rupture strength is good at 700F but the material becomes thermally embrittled when held for long times at this temperature. This material is not recommended for structural applications where high toughness is required or where the service temperature approaches 700F. Author (TAB)

N70-31051* National Lending Library for Science and Technology, Boston Spa (England).

FORMATION OF MAGNETITE FILM ON IRON

L. V. Sovetova et al 20 Apr. 1970 8 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Ukrania SSR), v. 9, no. 8, 1969 p 83-86 In ENGLISH and RUSSIAN

(NLL-Trans-746-401-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The formation of oxide films on iron at low temperatures (below 600 C) is investigated by studying the growth rate of the film. Curves of oxidation of iron powder in a medium of superheated steam for temperatures of 400, 450 and 550 C are presented, and the coefficient of diffusion of pure iron in the film of Fe3O4 were calculated. F.O.S.

N70-31053# Boeing Co., Renton, Wash. Commercial Airplane Div.

METALLURGICAL STABILITY OF THE TITANIUM ALLOYS 8Al-1V-1Mo, 6Al-6V-2Sn, 4Al-3Mo-1v, and 6Al-4V

Pete T. Finden 15 Dec. 1969 69 p refs

(AD-700853; D6-24515) Avail: CFSTI CSCL 11/6

Four commercial alloys - Ti 8Al-1Mo-1V, Ti 6Al-6V-2Sn, Ti 4Al-3Mo-1V, and Ti 6Al-4V - were evaluated to determine the effect of SST environmental conditions on mechanical properties. Test data for materials subjected to stressed thermal exposures for times from 1000 hours to 30,000 hours are compared to as-heat treated properties for most of the common heat treatment conditions (solution treated and overaged, mill annealed and air cooled, and duplex annealed with air cooling) of these alloys. It was found that of the alloys examined, only Ti 6Al-4V is not detrimentally affected by the exposure conditions tested. The test results indicate that furnace cooling (at 80F/hour to 800F in this study) from either the annealing temperature or the aging - stabilization treatment imparts the required metallurgical stability for SST usage of the other three alloys - Ti 8Al-1Mo-1V, Ti 6Al-6V-2Sn, and Ti 4Al-3Mo-1V. Property changes resulting from exposure are satisfactorily explained by changes in microstructural features as determined using transmission electron microscopy and X-ray diffraction. Author (TAB)

N70-31094# Royal Aircraft Establishment, Farnborough (England).

ON DISSIPATION OF ENERGY IN A CYCLICALLY DEFORMED MATERIAL IN THE PRESENCE OF STATIC STRESSES [PRO ROZSIYANNYA ENERGII V MATERIALI SHCHO TSIKLICHNO DEFORMUET'SYA PRI NAYAVNOSTI V N'OMU STATICHNIKH NAPRUZHEN]

G. S. Pisarenko et al Nov. 1969 10 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR, Ser. Fiz.-Techn. Ta. Matemat. Nauki (Kiev), no. 1, 1969 p 49-52

(RAE-Lib-Trans-1409) Avail: CFSTI

Experimental studies show that the dissipation of energy in certain metals tends to be reduced by superimposed static stress and increased by preliminary plastic strain. The Baushinger effect in the microvolumes of the material is proposed as the cause, and this is substantiated by consideration of the fatigue strength of metals under asymmetrical cycling. Author

N70-31102 National Lending Library for Science and Technology, Boston Spa (England).
CARBURIZATION RESISTANCE OF HIGH-ALLOY STEELS
K. I. Cheskis et al 20 Apr. 1970 11 p Transl. into ENGLISH from Metallov. i Term. Obrabotka Metallov. (USSR), no. 8, 1969 p 32-36 In ENGLISH and RUSSIAN
(NLL-Trans-746-434-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The experiments show that the standard Cr-Ni austenitic 23Cr-18Ni and 18Cr-10Ni-Ti steels possess low carburization resistance. The best carburization resistance is in 20Cr-14Ni-2Si and 25Cr-16Ni-7Mn-N-B steels. The ferritic 25Cr-5Al steel is totally resistant to carburization. Increasing the silicon content from 2.16 to 2.8% in 20Cr-14Ni-2Si steel and from 0.34 to 1.15% in 25Cr-16Ni-7Mn-N-B steel increases their carburization resistance. Decreasing the manganese content in steels with an average silicon content increases the tendency to carburization, while an increase in manganese content protects the high carburization resistance. An increase in boron and nitrogen also increases carburization resistance. Author

N70-31103 National Lending Library for Science and Technology, Boston Spa (England).
DECREASING BRITTLENESS OF BORONIZED LAYER
M. A. Shalya 20 Apr. 1970 5 p refs Transl. into ENGLISH from Metallov. i Term. Obrabotka Metallov. (USSR), no. 8, 1969 p 69 In ENGLISH and RUSSIAN
(NLL-Trans-746-433-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The samples of electrolytically boronized Cr-Ni-W steel were heated in hermetically sealed boxes with charcoal and in a vacuum furnace at 900 to 940 C for 4 to 20 hours. It was assumed that partial deboronization, along with boron diffusion into the sample, would take place, causing the FeB phase to be removed from the surface of the layer; the structure of the remaining layer would consist of borides separated by a ductile phase due to further diffusion. The studies show that deboronization takes place more intensively under the carbon layer and the surface layers deboronize completely. After soaking for 4 hours, a completely deboronized layer is observed on the surface and deboronized zones are observed in the depth of the boronized layer. The microhardness of the deboronized particles is H 297, of the base material beneath the boronized layer H 429, and in the lower part of the boronized layer H 800 to 1000. Deboronization does not take place during heating in a vacuum. The depth of the boronized layer after soaking for 20 hours increases by 30 to 40% and the microhardness remains unchanged. Electrolytic boronization is the method most suitable to decrease the brittleness of the boronized layer. Author

N70-31154 National Lending Library for Science and Technology, Boston Spa (England).
COMPOSITION OF PHASES IN TICONAL ALLOY (YuNDK35T5)
E. Y. Zelster et al 20 Apr. 1970 5 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 28, no. 3, 1969 p 568-569 In ENGLISH and RUSSIAN
(NLL-TRANS-746-466-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

To explain the composition of phases specifying a high coercive force in Ti-Fe-Co-Ni-Al-Cu (Ticonal), electrochemical separation of the phases was attempted. It was found that an electrolyte consisting of citric acid, ammonium sulfate, nitric acid, and methanol precipitated the intermetallic phases from the nickel based alloys. During dissolution of the alloy in the electrolyte, the anodic residue of the alpha phase was isolated. The complete absence of copper in the precipitated residue attests the fact that the copper containing alpha prime phase did not form part of the residue. From a spectroscopic analysis of the initial alloy, the relative amount of phases in it was found to be equal and the composition of the second alpha prime phase was calculated. Thus, the Ticonal alloy after tempering at 800 C consists of two phases, one of which is enriched by Al, Ti, and Ni (alpha), and the second (alpha prime) with a Fe base. The high cobalt content in the alpha responds to the equilibrium composition of the phase at 800 C. For the alloy in a metastable state, responding to a high coercive force, it was assumed that a large quantity of cobalt is contained in the strongly magnetic alpha prime phase. S.S.

N70-31165# Reactor Centrum Nederland, Petten.
CORROSION OF INCONEL-625, HASTELLOY X280 AND INCOLOY-800 IN 550-750 DEG C SUPERHEATED STEAM. INFLUENCES OF ALLOY HEAT TREATMENT, SURFACE TREATMENT, STEAM VELOCITY AND STEAM TEMPERATURE. PART 1: RESULTS UP TO 6000 HOURS EXPOSURE TIME
P. J. van Tilborg and A. van der Linde Oct. 1969 98 p refs
(RCN-109) Avail: CFSTI

Sheet samples of Inconel-625, Hastelloy-X280 and Incoloy-800 were tested in steam with velocities of 5 and 85 m/sec at 550, 650, and 750 C. Post-corrosion sample investigations involved measurement of the adherent oxide thickness, the total amount of corroded metal, the metal loss to system, and the metallographic and microprobe investigation of the adherent oxide film and adjacent diffusion disturbed alloy layer. The results obtained up to 6000 hours exposure time showed that the surface treatment has a decisive influence on the corrosion behavior of all three alloys tested. Author (ESRO)

N70-31170 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF COBALT ON SOME PHYSICAL PROPERTIES OF Fe Ni INVARS
O. A. Khomenko et al 20 Apr. 1970 12 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 28, no. 1, 1969 p 104-109 In ENGLISH and RUSSIAN
(NLL-Trans-746-405-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The effect of cobalt on the Curie point, the anomaly in Young's modulus and the thermal expansion of Fe-Ni Invars as a IKW substitute for nickel was investigated. In low-Fe alloys, the Curie point increases with addition of copper, and in high-Fe alloys it decreases. It was established, that cobalt reinforces the Invar anomaly of the modulus of elasticity and lowers the Delta E-effect in Fe-Ni alloys. The data obtained show that the absence of an Invar effect in binary Fe-Co alloys with an fcc lattice is explained by the presence of the alpha phase in the range of compositions, in which the appearance of Invar properties of the austenite is possible. Author

N70-31229# Duke Univ., Durham, N.C.
STRAIN DISTRIBUTIONS IN THIN GOLD FILMS
C. Blake Mc Dowell Feb. 1970 127 p refs Sponsored in part by NSF and Shell Companies Found, Inc.
(Contract AT(40-1)-2430)
(ORO-2430-50) Avail: CFSTI

A method for determining the strain distribution through the thickness of thin metallic films is developed. The strain distributions of the films are related to the directions in which the films curl and, through a set of nonlinear simultaneous equations, to the shapes of their X-ray diffraction peaks. These equations are solved by assuming a piecewise linear approximation of the strain distributions. This resulting approximation is fit by a five-parameter, nonlinear distribution, which is derived from elasticity theory for materials of grade 2. The X-ray method is applied to vacuum deposited gold films deposited onto a Bi_2O_3 nucleation layer which has similarly been deposited onto a glass substrate. The deduced

nonlinear strain distributions are nearly antisymmetric with the substrate side in tension and the free side in compression as measured normal to the substrate. Surface strains are as high as + or − 2.5 percent and decay approximately exponentially from the surfaces. Author

N70-31283 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF ANALYZING IMPACT STRENGTH INTO ITS COMPONENTS
1970 4 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 35, no. 5, 1969 p 612–615
Avail: Natl. Lending Library Boston Spa, Engl.: .1 NLL photocopy coupons

A proposed method of analyzing impact strength by its components is critically studied. The method is based on the assumptions that: (1) the impact strength depends linearly on the radius of curvature of the base of the notch, and (2) the impact strength is equal to the sum of the energy of crack initiation and the energy of crack propagation. Graphs constructed from experimental data are examined, and it is concluded that impact strength determined by these components is not in agreement with general views on fracture due to impact loading, and is not confirmed experimentally. F.O.S.

N70-31284# Technische Hogeschool, Eindhoven (Netherlands).
CONTRIBUTION TO ULTRASONIC INVESTIGATION OF MATERIALS WITH PARTICULAR APPLICATION TO MANGANESE-IRON SPINELS [EEN BIJDRAGE TOT HET ULTRASOONONDERZOEK VAN MATERIALEN IN HET BIJZONDER TOEGEPAST OP OXYDISCHE MANGAAN-IJZERSPINELLEN]
Johan Hendrik Hendriks (Ph.D. Thesis) 1970 88 p refs In DUTCH; ENGLISH summary
Avail: CFSTI

The ultrasonic properties of the manganese-ferrites are investigated from 50 kHz to 60 MHz at temperatures from 80 to 450 K. The samples used were polycrystalline or monocrystalline with a manganese content from 0.7 to 1.8. The propagation of mechanical waves in isotropic, cubic, and polycrystalline materials are described. The measuring methods, relaxation processes, and literature on the ultrasonic properties of the specimens are surveyed. The circuits and apparatuses used in the measurements are described and the measurement results are given. Author

N70-31287 Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Engineering Dept.
THE CORROSION BEHAVIOR OF CUNIFER-10 ALLOYS IN SEAWATER PIPING SYSTEMS. PART 2: METALLURGICAL STUDIES ON CUNIFER-10 ALLOYS
P. J. Berg and R. G. De Lange Nov. 1969 27 p refs
(Rept-134-M; TDCK-54782) Copyright. Avail: Issuing Activity

A detailed description is given of the fundamental metallurgical studies on cunifer-10 alloys. The basic knowledge concerning the role of impurities in the alloy, segregation, precipitation and oxidation has determined the important parameters in corrosion testing. Author

N70-31307# Pennsylvania State Univ., University Park. Dept. of Materials Science.
INTERMETALLIC COMPOUNDS OF YTTRIUM Final Report, 18 Sep. 1963 – 31 Jul. 1969
Earle Ryba 31 Jul. 1969 18 p refs
(Contract DA-31-124-ARO(D)-129)
(AD-702985; AROD-4345-5-MC) Avail: CFSTI CSCL 11/6

The first objective of this investigation was to determine the phase diagram for the yttrium-cadmium binary system, and thus determine what intermetallic compounds occur in this system. The crystal structures of these compounds were to be studied and compared to those of other yttrium binary compounds in an attempt to learn something about the interatomic bonding in these materials. The second objective of this investigation was to investigate the phase relations in the yttrium-cadmium-zinc alloy system in an attempt to determine the extent to which zinc atoms could be substituted for cadmium atoms and vice versa. This would provide information on the effect of changes in size and perhaps bonding type on alloy formation. Finally, it was hoped that an investigation of the relationship between the crystal structure of the yttrium-cadmium intermetallic compounds and their mechanical properties could be begun. Author (TAB)

N70-31358 National Lending Library for Science and Technology, Boston Spa (England).
COMPARISON OF DIFFERENT METHODS OF ANALYZING IMPACT STRENGTH
V. D. Zelenova et al 1970 3 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), v. 35, no. 5, 1969 p 611–612
(NLL-Risley-Trans-1775-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Several methods of analyzing impact strength by the energy of crack initiation, and the energy of crack propagation are compared. A method is proposed for analyzing impact strength by the percentage share of fibers in the fractures at the lower cold brittleness threshold temperatures. Functions for steel hardening at 850 C and tempering at 500 C are shown. Comparative data of the analysis are tabulated. It is concluded that all the methods produce substantially the same result, and the choice for use depends on their practicality for each case. F.O.S.

N70-31362 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF THERMOMECHANICAL TREATMENT ON THE MAGNETIC PROPERTIES OF Al-Ni TYPE ALLOYS
A. S. Ermolenko et al 20 Apr. 1970 14 p ref Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 27, no. 4, Apr. 1969 p 689–695 In ENGLISH and RUSSIAN
(NLL-Trans-746-485-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

It is shown that thermomechanical treatment of monocrystals of Al-Ni alloys leads to a marked increase of the coercive force, remanent induction, and maximum magnetic energy compared with values attainable by heat treatment without stress application. A beneficial effect is achieved by uniaxial tension of the crystals along the <100> axis or by equivalent biaxial tension or uniaxial compression. The effect observed in the polycrystalline specimen is much less pronounced than in monocrystals. Author

N70-31363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF ELASTICITY OF TUNGSTEN, MOLYBDENUM, NIOBIUM, AND THEIR ALLOYS AT 20 TO 2,700 C
V. A. Dreshpak 9 Mar. 1970 10 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR, Ser. A (Kiev), v. 29, no. 10, 1967 p 917–921
(AD-704010; FTD-HT-23-305-69) Avail: CFSTI CSCL 11/6

The article presents the results of experiments, and determines the modulus of elasticity and rigidity of tungsten, molybdenum, niobium and their alloys at 20-2700 degrees centigrade. Ingots of the above metals and their alloys were heated to 1400-1600 degrees centigrade and deformed with 60-85 percent reduction. The modulus of elasticity and rigidity of specimens prepared from the ingots were determined by means of a dynamic method using a resonant frequency of the transverse and torsional vibrations. It was found that the modulus of elasticity and rigidity of tungsten, molybdenum, and tungsten-molybdenum alloys decreased with increasing temperature. The modulus of elasticity and rigidity of

niobium remained practically constant to about 1400 degrees centigrade beyond which they began to decrease with increasing temperature. Alloying with tungsten and molybdenum increased the modulus of elasticity and rigidity of niobium alloys. TAB

N70-31370 National Lending Library for Science and Technology, Boston Spa (England).
ROLE OF SURFACE ENERGY IN INITIAL PERIOD OF SINTERING
P. S. Kislii et al 20 Apr. 1970 5 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 9, no. 11, Nov. 1969 p 21 – 25
(NLL-Trans-746-473-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

An overview is presented of previously derived data dealing with the intensive shrinking in brittle materials during the initial period of sintering. Based on analyses of these data, it is concluded that: (1) in the initial period of sintering, an intensive shrinkage is specified by the threshold creep of finely dispersed particles, for which the capillary pressure exceeds the yield point; and (2) with partially refractory compounds, intensive shrinkage in the initial period of sintering is linked basically with processes of threshold creep under the action of surface tension forces and takes place if the dimensions of the particles of the sintered material are less critical. D.L.G.

N70-31372 National Lending Library for Science and Technology, Boston Spa (England).
PROSPECTS OF USING NATURAL-ALLOYED RAW MATERIALS FOR OBTAINING IRON POWDERS
V. Y. Bulanov et al 20 Apr. 1970 7 p Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 9, no. 8, 1969 p 27 – 30 In RUSSIAN and ENGLISH
(NLL-Trans-746-399-(9022.401) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The possibilities of using the slag of low-allowed steel for obtaining iron powders was investigated. The most promising method is considered to be the reduction of a combination of carbon black and the waste. F.O.S.

N70-31373 National Lending Library for Science and Technology, Boson Spa (England).
OBTAINING SPHEROIDAL GRAPHITE IN CAST IRON WITHOUT SPHEROIDIZERS
R. A. Siderenko et al 20 Apr. 1970 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 12, no. 9, 1969 p 136 – 140 In RUSSIAN and ENGLISH
(NLL-Trans-746-476-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A test was conducted to prove experimentally the possibility of obtaining spheroidal graphite in cast iron without spheroidizers, with slow cooling. Results of the experiments indicate that the basic cause of spheroidal graphite formation is the deep purification of the melt from sulfur and some other surface active elements, which takes place during treatment of the liquid cast iron by spheroidizers. It was discovered, however, that in particularly pure cast iron, containing not more than 0.00004% sulfur, at solidifying rates of less than 3 mm/min, complete spheroidization of the graphite does not take place, and during a particularly slow solidification, practically all graphite becomes flaked. It was concluded that: (1) while the deep purification of cast iron from surface active elements is indisputably basic, it is not the only condition for complete spheroidization of the graphite; and (2) the introduction of spheroidizers is not necessary for obtaining all the graphite in a spheroidal form. D.L.G.

N70-31419# Oak Ridge National Lab., Tenn.
CREEP-RUPTURE PROPERTIES OF SU 16 AND THEIR RESPONSE TO HEAT TREATMENT
R. L. Stephenson Mar. 1970 15 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2835) Avail: CFSTI

The creep-rupture properties of SU-16, a niobium-base alloy (Nb-11% W-3% Mo-2% Hf-0.08% C), have been determined for times up to 1000 hr at 980, 1095, and 1205 C. Creep tests were performed at pressures not exceeding torr. Results of comparison with other data indicate that Su-16 is one of the stronger niobium-base alloys. The effect of pretest annealing temperature on the creep-rupture properties was studied. Heat treatment at 1425 C weakened the alloy, but heat treatment at higher temperatures up to 1650 C increased strength; these effects persisted for at least 1000 hr. Author (NSA)

N70-31420# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METALS AND ALLOY CONTAINING DISPERSED INCLUSIONS OF REFRACTORY COMPOUNDS AND FIBERS
E. I. Mozzhukhin 13 Jan. 1970 58 p refs Transl. into ENGLISH from the Russian
(AD-704288; FTD-MT-24-329-69) Avail: CFSTI CSCL 13/8

The work studies the introduction of dispersed inclusions of refractory compounds in metals and alloys to considerably strengthen the mechanical properties of the metal base. Three areas are dealt with in particular: (1) development of methods of obtaining dispersion-hardened materials (internal oxidation, selective reduction and others), (2) investigation of dispersion-hardened materials, including the most important question of the stability of the hardening phase and study of the mechanism of influence of dispersed inclusions on properties of the materials, (3) study of metals and alloys containing fiber. TAB

N70-31425# British Steel Corp., London (England). Metallurgy Div.
A NEW APPROACH TO SUB-CRITICAL FLAW GROWTH
M. J. May, C. E. Nicholson, and A. H. Priest 1968 21 p refs Presented at BISRA/ISI Conf. on Low Alloy Steels, Scarborough, Engl.
(MG/A/54/68) Avail: CFSTI

The application of linear elastic fracture mechanics to the study of subcritical flaw growth by stress corrosion cracking and fatigue are considered. It is shown that the factor controlling crack propagation is the stress intensity at the tip of the crack. The benefits of the fracture mechanics approach over the more conventional qualitative approaches are discussed and examples are given of the effect of environment and metallurgical factors on the stress corrosion cracking limit. An indication is given of the application of this approach to design considerations involving subcritical flaw growth. It is concluded that under such conditions the critical properties are the crack propagation characteristics of materials and that development of improved materials should be directed towards higher plane strain fracture toughness values and lower crack growth rates. Author

N70-31449*# Stanford Research Inst., Menlo Park, Calif.
THE EFFECT OF SILICON AND MANGANESE ON THE OXIDATION OF Ni-20 Cr AND Co-20 Cr ALLOYS
D. L. Douglass May 1969 77 p refs
(Contract NAS3-11165)
(NASA-CR-72607) CSCL 11F

Additions of 3% silicon or manganese to Ni-20Cr reduced the oxidation rate, whereas, additions of 1% had little effect. Three percent silicon alloys formed an inner scale of SiO2, and three percent manganese alloys formed an inner spinel layer of essentially pure MnCr2O4. The experimentally determined solid-state growth rate of NiCr2O4 was about 1000 times slower than the growth rate for Cr2O3. It was established that the protective layer on Ni-20Cr (Nichrome alloys) is the spinel and not Cr2O3 as previously

postulated. Similar measurements for the growth of $CoCr_2O_4$ showed that Cr_2O_3 is the protective layer on Co-20Cr. Mechanisms for scale growth are given for both Ni-20Cr and Co-20Cr alloys. Author

N70-31458# Defense Documentation Center, Alexandria, Va.
QUENCHING (COOLING), VOLUME 1 Report Bibliography, Jun. 1961 - Sep. 1969
Apr. 1970 157 p refs
(AD-704400; DDC-TAS-70-28-1) Avail: CFSTI CSCL 13/8

The references in the bibliography deal with various techniques of quenching metals and alloys to optimize their properties. Tests of the treated materials are made in the production of submarine hulls, rocket cases, gun components and machine tools. Author (TAB)

N70-31468# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
EMBRITTLEMENT BY LIQUID METALS Final Report, Jan. 1963 - Mar. 1968
A. R. C. Westwood and M. H. Kamdar Jan. 1970 10 p refs
(Contract DA-31-124-ARO(D)-63)
(AD-702961; AROD-3937-15-MC) Avail: CFSTI CSCL 11/6

A research project concerned with liquid-metal embrittlement (LME) is summarized. Of particular interest have been quantitative determinations of the fracture behavior of simple embrittlement couples such as pure solid zinc in pure liquid mercury, in order to provide the basis for a better understanding of the mechanism of LME. Author (TAB)

N70-31500 National Lending Library for Science and Technology, Boston Spa (England).
MECHANISM OF OXIDATION OF DISPERSION-HARDENED NICKEL
O. A. Pashkova et al 20 Apr. 1970 6 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 5, no 5, 1969 p 569 - 571 In RUSSIAN and ENGLISH
(NLL-Trans-746-459-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Samples of pure nickel and nickel with additions of 12% Y_2O_3, obtained by powder metallurgy, were investigated. The tests were conducted in air within a temperature range of 1,000 to 1,200 C. Metallographic examination showed that the oxide film, forming on the Ni plus 12% Y_2O_3 alloy, consists of two clearly defined layers; an external compact dark-colored layer and an internal porous light-green layer. The formation of the internal porous layer was considered to be linked with the dissociation during oxidation of the external layer. X-ray analysis of the oxide formed during oxidation of the Ni plus 12% Y_2O_3 alloy showed the presence of Y_2O_3 inclusions as an independent phase. Additional analyses resulted in the following findings: (1) The rate of oxidation of Ni plus 12% Y_2O_3 alloy is 1.1 to 1.3 times less than that of pure nickel. This could be explained by the protective barrier action of the particles of the Y_2O_3 phase, situated in the internal layer of the scale. (2) The effective oxidation activation energy of pure nickel and a nickel alloy ith 12% Y_2O_3 is identical in air at the specified temperature range. D.L.G.

N70-31508 National Lending Library for Science and Technology, Boston Spa (England).
ACTIVATION OF COMPACTION DURING SINTERING OF SOME METAL ALLOYS. PART 1: EFFECT OF SILVER ON KINETICS OF SHRINKAGE OF Cu Al ALLOYS
V. I. Itin et al 20 Apr. 1970 17 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Ukrania SSR), v. 9, no. 8, 1969 p 41 - 49 In ENGLISH and RUSSIAN
(NLL-Trans-746-400-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The effect of silver on the sintering of copper and aluminum alloys was studied to obtain intense shrinkage for obtaining dense and stable alloys. Copper, aluminum and silver powders with particle dimensions of less than 50 microns were used in preparing the alloys. From the prepared mixtures samples with an initial porosity of 20 to 22% were pressed, and sintered. It was found that alloying with silver accelerates the process of formation of solid solutions, and improves sintering at both low and high temperatures. F.O.S.

N70-31529# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.
STRESS-CORROSION CRACKING BEHAVIOR OF AN 18 PERCENT Ni MARAGING STEEL
A. J. Stavros and H. W. Paxton Apr. 1970 36 p refs
(Contract Nonr-760(31); ARPA Order 878
(AD-704174) Avail: CFSTI CSCL 11/6

Stress-corrosion cracking of an 18% Ni maraging steel in aqueous solutions was studied using precracked cantilever beam specimens. By appropriate heat treatments, six different structures having the same yield strength were obtained. Although significantly different plane strain fracture toughness values (K_{Ic}) resulted, it was found that the threshold plane strain stress intensity (K_{Iscc}) was the same for all structures. K_{Iscc} had the same value in 3% NaCl at various pH values, in IN H_2SO_4, and in distilled water. Specimens tested in 3% NaCl under both anodic and cathodic applied potentials also exhibited this same K_{Iscc} value. Fractographic inspection of the crack surfaces revealed no apparent differences due to changes in solution, pH, or applied potential. The crack path was intergranular in all cases. However, specimens austenitized at 1500 F exhibited crack branching, whereas in specimens austenitized at much higher temperatures branching no longer occurred. Aging time and temperature seemed to change only the time to failure. The mechanism most consistent with all observations appears to be hydrogen cracking. Author (TAB)

N70-31569# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH ON CREEP AND ON THE STRENGTH OF NONUNIFORMLY HEATED TURBINE DISKS OF ALLOYS EI-437B AND EI-787
I. I. Ostapchuk et al 31 Dec. 1969 16 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 3, 1968 p 70 - 76
(AD-702956; FTD-MT-24-333-69) Avail: CFSTI CSCL 11/6

A comparative analysis of the EI-787 Fe-Cr-Ni base alloy and the EI-437B Ni alloy as materials for turbine disks is presented. The experiments were carried out on two series of four disks each (diameter 402 mm). Two disks in each quartet had a normal profile and the other two, a lightweight profile; one disk in each pair contained eight small (diameter 6 mm) eccentrically aligned orifices serving as stress concentrators. The strength of the disks was evaluated as a function of the residual deformation arising in connection with creep during tests at normal rotational speed (15,500 r.p.m.) during 5 min., 5, 10, 25, 50 hr. (stage 1 of tests), as well as a function of time to fracture during increased rotational speed (19,200 r.p.m.) (stage 2 of tests). In addition, short-time and long-time mechanical properties of both alloys were investigated on specimens cut out from disks and forgings. Findings: The strength of normal-profile disks of both alloys is roughly the same, as is the degree of their deformation. Lightweight-profile disks fractured in the presence of smaller loads (lower rotational speeds) and their deformation reached a greater degree than normal-profile disks; this effect was more pronounced for the EI-437B alloy. TAB

N70-31647*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FABRICATION OF URANIUM MONONITRIDE COMPACTS

Robert R. Metroka Washington Jul. 1970 29 p refs
(NASA-TN-D-5876; E-5494) Avail: CFSTI CSCL 11F

Uranium mononitride (UN) compacts were fabricated by cold isostatic pressing and sintering, hot isostatic pressing, and hot extrusion. Fine UN (<1 micrometer) powder was used for the sintering studies. The effects of sintering temperature and time on the density, grain size, and oxygen and carbon content of the sintered compacts were studied. Coarse (70 to 150 micrometers) UN powder was compacted by hot isostatic pressing. The effects of pressing pressure, temperature, and canning materials were studied. Cursory studies were made on hot extrusion of the coarse UN powder and on machining of sintered compacts. Author

N70-31667# Oak Ridge National Lab., Tenn.
OXIDATION OF VANADIUM AND VANADIUM ALLOYS IN SODIUM
R. L. Klueh and J. H. De Van Mar. 1970 24 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2827) Avail: CFSTI

Alloys containing titanium and aluminum absorb oxygen with the simultaneous formation of a subsurface hardened zone. The depth of this zone depends on time, temperature, the oxygen content of the sodium, and the composition of the alloy. Pure vanadium or vanadium containing chromium or niobium absorbs oxygen somewhat faster and without the formation of a pronounced hardened zone.The published corrosion results for vanadium-titanium and vanadium-aluminum in terms of internal oxidation were examined. In this process oxygen dissolves in the alloy and reacts with the dissolved titanium or aluminum to form TiO2 or Al2O3, which precipitates. This precipitate gives rise to the hardened zone. It has been shown that the kinetics of hardened zone formation obeys the internal oxidation model proposed by Wagner when no vanadium oxide scale forms on the external surface and obeys the model proposed by Rapp and Colson when an external scale forms. Discussions are included on how internal oxidation theory and alloy oxidation theory (noninternal oxidation) can be used in the development of alloys for sodium applications. Author (NSA)

N70-31692# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.
RESEARCH ON THE STABILITY OF THE BODY-CENTRED-CUBIC STRUCTURE ON METALS AND ALLOYS Final Scientific Report, 1 Jan. 1963 - 1 Jan. 1968
R. W. Smith and M. E. Brookes 1969 12 p refs
(Grant AF-EOAR-4-67)
(AD-703937; AFOSR-68-1982) Avail: CFSTI CSCL 20/2

The experimental results obtained in this study of the stability of the body-centred-cubic structure in alloys of the noble metals demonstrate the complexity of a complete understanding of beta-phase stability. Although consistent interpretation in terms of simple, physical constants cannot be made, the observations point to the significant role played by ordering forces. Author (TAB)

N70-31738# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROSLAG REMELTING AND WELDABILITY OF AUSTENITIC STEELS
B. I. Medovar 20 Jan. 1970 18 p refs Transl. into ENGLISH of the publ. "Novye Problemy Svarochnoi Tekhniki" Kiev, Izd. Tekhnika, 1964
(AD-704200; FTD-MT-24-376-69) Avail: CFSTI CSCL 11/6

Problems connected with crystalline crack formation have been studied in the austenitic joint based on parimary crystallization in the welding bath. However, the formation of cracks in the base metal is more involved. The cracks appear between the grains in the overheated zone close to the joint, and consist of both crystalline cracks and intergranular cracks. The conditions of formation of intergranular cracks have been investigated insufficiently. The main cause of their appearance is not only embrittlement by precipitation, but also by contamination of the boundary volumes of austenitic grains with fusible elements such as phosphorus, sulfur, lead, tin, antimony, arsenic, non-metallic inclusions and gases. Cracking of austenitic steel is thus caused by its contamination. Author (TAB)

N70-31748# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
ENVIRONMENT SENSITIVE MECHANICAL BEHAVIOUR OF MATERIALS Final Report, 31 Mar. 1968 - 30 Jun. 1969
M. H. Kamdar (Northrop Corporate Labs.) Dec. 1969 6 p refs
(Contract DA-31-124-ARO(D)-63)
(AD-702960; AROD-3937.14-MC) Avail: CFSTI CSCL 11/6

An investigation concerning the role of solute atoms on crack initiation in dilute zinc alloys in mercury was completed. Author (TAB)

N70-31752# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABRASIVE WEAR RESISTANCE OF STRUCTURAL STEELS DEPENDING ON THE HEAT-MECHANICAL TREATMENT HIGH-TEMPERATURE AND LOW-TEMPERATURE TREATMENT
V. Ya. Zharkov et al 25 Feb. 1970 13 p refs Transl. into ENGLISH from Trenie i Iznos v Mashinakh, Akad. Nauk SSSR, Inst. Mashinoved. SB. (Moscow), no. 20, 1968 p 65 - 71
(AD-704022; FTD-HT-23-38-70) Avail: CFSTI CSCL 11/6

Data on the influence of heat mechanical treatment on the abrasive wear resistance and other mechanical properties of some structural steels is presented. All steels were subjected to high temperature heat mechanical treatment: heating to a temperature above the maximum critical point; rolling with reductions of 15, 30, and 45 percent; annealing; and tempering at temperatures of 100, 200, 400, and 600 degrees centigrade. Steel 40KhNMA was subjected to low temperature heat mechanical treatment: heating above the maximum critical point to austenitic state, recooling to temperatures of 480 to 520 degrees centigrade in the intermediate stability region with a prolonged incubation period, and rolling, annealing and tempering as the other steels. The optimal abrasive wear resistance of the steels studied is basically determined by the preliminary degree of plastic deformation of austenite and the tempering temperature after annealing. Author (TAB)

N70-31763# Lockheed Missiles and Space Co., Palo Alto, Calif.
P-T-X DIAGRAM OF LEAD TELLURIDE
A. M. Gaskov et al [1970] 2 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. II: Khim. (Moscow), no. 1, 1970 p 49 - 50
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The lead telluride P-T-X diagram was investigated. The position of the three-phase equilibrium line, determined from optical absorption data, does not agree with the results of experiments in which the dependence of the smelting temperature on the partial pressure of tellurium was studied. The temperature dependence of the saturated vapor pressure corresponding to three-phase equilibrium (liquid+solid+vapor) in the tellurium-lead system was studied by a static method. The saturated vapor pressure was measured by using a Bourdon quartz manometer. The samples for investigation were fabricated by smelting tellurium (99.999) and lead (C-000) in quartz ampoules, and subsequently quenching the ampoules in water from a 700 C temperature. Compositions of 50.5 and three phases (liquid+PbTe(solid) + vapor) in the 500 - 900 C temperature range. The results of measuring the pressure during heating and cooling did not differ by more than 3%. The temperature dependence of the partial vapor pressure P(PbTe) in the system under consideration was studied by the optical absorption method and was used to compute the partial pressure P(Te2). Author

N70-31763# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.

ANOMALIES OF THE MATTHIESSEN RULE IN COPPER [ABWEICHUNGEN VON DER MATTHIESSEN REGEL IN KUPFER]

Bruno Lengeler (Ph.D. Thesis—Tech. Hochschule, Aachen) May 1969 125 p refs In GERMAN
(JUL-593-FN) Avail: CFSTI

Concurrent scattering of conducting electrons by different kinds of scattering centers induces a deviation in partial resistance values for metals. A suitable combination of scattering centers makes it possible to separate the effects of two different impurities resulting from anisotropies of Fermi surfaces as well as from changes in phonon components of the electrical resistance. Measurements of the longitudinal magnetic resistance changes in copper are described where electron scattering takes place on point defects as well as on interstitial atoms. A two-band model for copper is used to explain scattering from an anisotropic Fermi surface and the differing wave characteristics of the conduction electrons in the individual neck and belly of the Fermi surface. Transl. by G.G.

N70-31841# Illinois Univ., Urbana.

SECOND AND THIRD-ORDER ELASTIC CONSTANTS OF ALUMINUM AND LEAD

Tetsuro Suzuki Feb. 1970 32 p refs
(Contract AT(11-1)-1198; Grant AF AFOSR-803-65)
(COO-1198-704) Avail: CFSTI

The second and third order elastic constants of Al and Pb are calculated as the second and third derivatives of the binding energy with respect to the finite deformation parameter. The binding energy is derived from a local pseudopotential by use of second order perturbation theory. It is shown that the binding energy satisfies not only the diagonal equilibrium condition but also the off-diagonal equilibrium condition, i.e. the first derivatives of the binding energy with respect to a volume change as well as shear deformations are zero. The present method of calculation is based on a stable lattice model. The results of the present calculation for the third order elastic constants of Al are found to be in satisfactory agreement with the experimental data of the complete set of third order elastic constants. Author

N70-31880# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Material Science.

MECHANICAL PROPERTIES OF REFRACTORY METALS AND ALLOYS Final Report

T. E. Mitchell Feb. 1970 15 p refs
(Grant AF-AFOSR-1501-68)
(AD-703733; AFOSR-70-0664TR) Avail: CFSTI CSCL 11/6

The objectives of the research on the mechanical properties of refractory metals and alloys was to relate the fundamental nature and behavior of dislocations to the observed mechanical properties. The main emphasis has been on body-centered cubic metals and most of the work has utilized single crystals. A great deal has been achieved in advancing the understanding of the relationship of the properties of dislocations to the crystal lattice and hence to the mechanical properties. The most exciting aspects of this work relate to the high yield stress of bcc metals at low temperatures. This was variously interpreted as due to the intrinsic lattice friction stress (the Peierls stress) and to the interaction of dislocations with interstitial impurities. The Peierls stress can be thought of in more than one way, one of which (the pseudo-Peierls stress) involves a relaxation of the atoms near the core of a dislocation or, in other words, a local dissociation. These ideas can be used to explain many of the peculiar observations on slip in bcc metals, including multiple slip planes and slip asymmetry. Author (TAB)

N70-31955# Army Foreign Science and Technology Center, Washington, D.C.

CORROSION RESISTANCE OF SEMI-FINISHED PRODUCTS OF Ti-0.2% Pd ALLOY PRODUCED UNDER INDUSTRIAL CONDITIONS

N. D. Tomashov et al 20 Feb. 1970 14 p refs Transl. into ENGLISH from Zashchita Metallov (USSR), v. 5, no. 5, 1966 p 491–495
(AD-703912; FSTC-HT-23-493-70) Avail: CFSTI CSCL 11/6

The corrosion properties of semi-finished articles made from alloy 4200 (Ti-0.2% Pd) was studied. Smelting tests under semi-industrial conditions were made. It was found that this alloy may be used as a corrosion-resistant structural material. Author (TAB)

N70-31956# Army Materials and Mechanics Research Center, Watertown, Mass. Theoretical and Applied Mechanics Research Lab.

PLASTIC CONCENTRATION FACTORS IN FLAT NOTCHED SPECIMENS OF AISI 4340 STEEL

Ralph Papirno Feb. 1970 30 p refs
(AD-704337; AMMRC-TR-70-2) Avail: CFSTI CSCL 11/6

The Neuber rule is evaluated using an appropriate analytic representation of the stress-strain curve of AISI 4340 steel and predictions of maximum notch strain versus nominal net section stress are developed. The theoretical results, when compared with test data from flat notched specimens of the same material with a range of initial elastic concentration factors, show agreement within 5%. It is shown that the limitations of the strain gages in measuring the notch root strains can account for a major part of the discrepancy. Author (TAB)

N70-31958# Watervliet Arsenal, N.Y.

SOME OBSERVATIONS ON THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND MECHANICAL PROPERTIES IN LARGE CYLINDRICAL GUN TUBE FORGINGS

Richard S. DeFries, Charles J. Nolan, and Theresa V. Brassard Mar. 1970 43 p refs
(AD-702912; WVT-7018) Avail: CFSTI CSCL 19/6

A series of laboratory isothermal and continuous cooling heat-treatments were employed to develop and characterize the low temperature transformation products or microstructures which could be present in commercially produced large gun tube forgings. The tensile mechanical properties, hardness and Charpy V-notch impact transition curves were determined for each of the various microstructures produced. Of the three microstructures (martensite and two bainites) evaluated, tempered martensite produced the best combination of strength and toughness. Continuous cooling heat treating studies were used to demonstrate that a fully martensitic microstructure could be produced at the mid-radius of full size large gun tube forgings. Low yield strengths and impact energies were correlated with the tempered bainitic structures produced by transforming or quenching the gun steel forgings too slowly. Author (TAB)

N70-31983 Lehigh Univ., Bethlehem, Pa.

THE MORPHOLOGY AND STRENGTH OF IRON-CARBON MARTENSITE

Arnold Robert Marder (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-7346

The structure and mechanical properties of iron-carbon martensite containing between 0.2 – 1.86 weight percent carbon have been investigated. Metallographic observations showed that massive martensite forms in low-carbon iron alloys and is made up of packets of parallel platelets or laths. Transmission electron

microscopy together with the metallographic observations show that the structure of a massive packet consists of two components: (1) a matrix of laths with the same orientation and separated by low-angle boundaries, and (2) sets of other laths or platelets which have a different orientation from that of the matrix and are separated from the matrix by high angle boundaries. The habit plane for massive martensite was established by two surface trace analyses based on austenite orientations determined by two surface analyses of prior annealing twin boundaries. Dissert. Abstr.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-30819 Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Corrosion and Antifouling Dept.
DURABILITY TESTS WITH PREFABRICATION PRIMERS IN USE FOR STEEL PLATES
A. M. Van Londen and W. Mulder Jan. 1970 36 p refs
(Rept-120-C; TOCK-55162-III) Copyright. Avail: Issuing Activity

The tests included weathering exposure and sea water immersion tests with special attention to rust prevention. Although stress was laid on the behaviour of zinc rich paints, other types of prefabrication primers were involved in these comparative tests as well, viz. zinc dust paints containing approximately 70% zinc by weight, welding primers, modified wash primers, and an epoxy based red iron oxide paint. The problems of handling prefabrication primers are also discussed. The use of such paints for protecting steel against rusting before this material is being worked up offers big economical as well as technical advantages. Author

N70-30820*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT POLYMERIC MATERIAL INTERACTIONS DURING DECONTAMINATION, STERILIZATION AND THERMAL VACUUM EXPOSURES
W. D. Roper 15 Jun. 1970 16 p refs
(Contract NAS7-100)
(NASA-CR-110474; JPL-TR-32-1491) Avail: CFSTI CSCL 11I

An investigation was made of twelve pairs of typical spacecraft polymeric products to determine possible incompatibilities between the paired products which may occur during a spacecraft sterilization process and a spacecraft thermal-vacuum environment. The paired products were each placed in intimate contact and then given exposure to the following three environments: ethylene oxide-freon 12 decontamination, thermal sterilization, and long term thermal-vacuum exposure. Following the sequence of exposures, the products were given mechanical and electrical property tests in order to establish possible material degradation occurring during the exposures. Of the twelve material combinations studied, two were found to be incompatible. The incompatibility appeared to be directly attributed to an interaction between the paired products. The incompatible combinations involved a polyester film paired with a polyurethane product and the same polyester paired with a silicone elastomeric compound. A possible mechanism for the degradation process is presented. Author

N70-30822*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE STABLE, LOW SOLAR ABSORPTANCE, PIGMENTED THERMAL CONTROL COATINGS Final Report, 17 Oct. 1968 - 16 Oct. 1969
J. E. Gilligan, J. Brzuskiewicz, G. A. Zerlaut, and G. Yamate 15 Nov. 1969 192 p refs
(Contract NAS1-8166; IITRI Proj. C6166)
(NASA-CR-66917; IITRI-C6166-12) Avail: CFSTI CSCL 11C

Reflectance of white pigmented coatings and the environment-induced response of the fundamental properties determining it were formulated in terms of three models. The first defines spectral reflectance in terms of gross parameters and the indices of refraction and absorption of the components. The second model relates the changes in the gross spectral absorption coefficient as a function of the interaction of ultraviolet radiation and charged particles with fundamental materials properties. In the third model, the relationship between these changes and the gross spectral reflectance is stated in general terms. The majority of the experimental effort involved light scattering experiments. Spectral reflectance was measured against the parameters of discrete particle size, aggregate size, film thickness, and film structure. The powders were characterized by several techniques including BET, and optical and electron microscopy. Film structure strongly influences spectral reflectance. Author

N70-30928# Picatinny Arsenal, Dover, N.J.
VIBRATION TESTING OF RESILIENT PACKAGE CUSHIONING MATERIAL: POLYETHYLENE FOAM
George Zell Dec. 1969 101 p
(AD-701006; PA-TR-3610) Avail: CFSTI CSCL 13/4

A 2.3 PCF commercially produced cellular polyethylene cushioning was vibrated under simulated in package conditions. Tests were performed on several as produced and on a laminated thickness. Vibration was imposed on samples under static loads from 0.20 to 2.0 psi. Transmissibility was recorded in the frequency range 2 to 250 Hz. It was observed that vibration behavior was strongly influenced by material preload state. Effects are discussed and illustrated by dynamic force vs deformation curves measured in package. One preload state is shown to induce configurational nonlinearity while another is found capable of suppressing a specific type of nonlinear reaction peculiar to compression-loaded cushioning. Pertinence of observations to utilization of cushioning in protective suspensions is considered. A technique for normalizing nonlinear cushion response data is developed. Results of comprehensive tests on polyethylene foam are reduced to this format. Data indicates the dynamic stiffness of the foam at transportation-induced vibration frequencies is increased significantly over values derived from low rate (1.0 in./min) compression tests. Author (TAB)

N70-31153# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
PREPARATION AND PROPERTIES OF CARBON FOAM
A. E. Sands, M. E. Scrivner, and R. Paluzelle 23 Mar. 1970 50 p ref
(Contract W-7405-eng-26)
(Y-1706) Avail: CFSTI

The preparation and properties of carbon foam have been studied under production conditions at the Oak Ridge Y-12 Plant. The material has been prepared with densities ranging from 0.02 to 1.0 gm/cc; carbonization has been carried out at temperatures between 1,000 and 2,500 C. Powder additives have also been employed in the formulation. Compared with rigid organic foams, carbon foam is better for high-temperature applications, possesses higher compressive strengths at most densities, and maintains its dimensional stability even when immersed in water. Author

N70-31211# Oak Ridge National Lab., Tenn.
SHATTERPROOF COATINGS FOR GLASS
R. J. Gray Mar. 1970 15 p ref
(Contract W-7405-eng-26)
(ORNL-4521) Avail: CFSTI

The shatterproofing of glass with Silastic coatings, which can be applied in the laboratory, was investigated. The items tested

were light bulbs, Pyrex tubing, Dewar flasks, and capillary tubes. Two commercial products improved the impact resistance of the glass and greatly reduced shattering of the sharp particles. Investigation results can be used in minimization of the hazard of glass containers used in glove boxes. Author (NSA)

N70-31315# McGill Univ., Montreal (Quebec).
THE GLASS TRANSITIONS OF ALIPHATIC IONENES
A. Eisenberg, H. Matsuura, and T. Yokoyama 20 Mar. 1970 25 p
(Contract N00014-68-C-0237)
(AD-702753; TR-22) Avail: CFSTI CSCL 11/9

The glass transition temperatures of a wide range of ionenes have been studied as a function of the spacing of ions and the dielectric constant of the plasticizer. For solvents of a high dielectric constant the extrapolated glass transition of most ionenes has a value of ca. OC, while for plasticizers of a low dielectric constant the value centers around -80C. It is suggested that a conformational transition is responsible for this drastic change in the extrapolated Tg values. A q/a effect was also found, the slope of the Tg vs. q/a plot being 695, i.e. quite similar to that for the phosphates, silicates and acrylates. Author (TAB)

N70-31321# Forest Products Lab., Madison, Wis.
TENSILE STRESS-STRAIN BEHAVIOR OF FLEXIBILIZED EPOXY ADHESIVE FILMS
W. T. Simpson and V. R. Soper Mar. 1970 15 p refs
(AD-704262; FPL-12623) Avail: CFSTI CSCL 11/1

Films of several flexibilized epoxy adhesives were cast and the tensile stress-strain behavior was determined. The modulus of elasticity, maximum tensile stress, strain at failure and work to failure were measured. The maximum stress and the modulus of elasticity decreased in an approximately linear manner with flexibilizer content. A polysulfide flexibilizer definitely increased values for both strain at failure and work to failure. Polyamide, flexible epoxy and mercaptan-terminated polybutadiene flexibilizers showed very little effect on strain at failure and work to failure. These results demonstrate that the mechanical properties of epoxy adhesives can be manipulated. If the required mechanical performance for a specific end use can be defined, it should be possible to engineer a suitable epoxy formulation for a specific use. Author (TAB)

N70-31418# Sandia Corp., Livermore, Calif. Physical Research Div.
COMPOSITIONAL DEPENDENCY OF THE PERMEABILITY OF GLASS
J. E. Shelby Mar. 1970 26 p refs
(Contract AT(29-1)-789)
(SCL-RR-70-38) Avail: CFSTI

The effects of composition on the permeability of glass are discussed. It appears that the modifier content is just as important in determining the permeability of a given glass as is the network former concentration. The effect of hydroxyl content on permeability has not been established adequately, and the status of knowledge in this area is assessed. It was concluded that a systematic study of the effect of composition on permeability is needed to provide a clearer understanding of the mechanisms involved. Author (NSA)

N70-31422# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LOW DENSITY MATERIALS FOR BUOYANCY APPLICATIONS
H. D. Anderson Dec. 1969 41 p ref
(AD-701159; LMSC-D026046) Avail: CFSTI CSCL 13/10

The study was undertaken to develop and evaluate low-density materials for use in buoyancy applications at ocean depths to 10,000 ft. The study included a survey of commercial products and evaluation of composite materials and chemically foamed plastics. Description of the various materials is presented together with experimental data on their characteristics and behavior under hydrostatic loading. Recommendations are made for improving the strength versus density characteristics of the most promising materials. Author (TAB)

N70-31510# Aerospace Corp., El Segundo, Calif. Material Sciences Lab.
RELATIVE TOXICITY OF SELECTED POLYMERIC MATERIALS DUE TO THERMAL DEGRADATION
George Epstein and Julian Heicklen 15 Dec. 1969 17 p refs
(Contract F04701-69-C-0066)
(AD-703711; TR-0066(5250-20)-3; SAMSO-TR-70-115) Avail: CFSTI CSCL 11/9

A thermal-cecomposition-toxicity index is defined that includes the rate and temperature of thermal decomposition, as well as the quantity and toxicity of the resulting decomposition products. By means of this index, the relative toxicity due to thermal degradation is determined for selected heat-resistant thermoplastics and other polymeric materials. These are listed below in the order of least toxic first, most toxic last, when heated from 500 to 700F: (1) Teflon TFE; (2) Teflon FEP; (3) Kapton polyimide film; (4) Viton (assumed equivalent to Fluorel for this study); (5) Perfluoropropylene polymer; (6) Carboxy nitroso rubber. At lower temperatures, e.g., at 300 to 400F, the order of merit appears somewhat altered for Kapton polyimide film, Viton, and perfluoropropylene polymer. Author (TAB)

N70-31518# Owens-Illinois Glass Co., Toledo, Ohio. Corporate Research.
APPLICATION OF X-RAY SPECTROSCOPY IN GLASS AND GLASS-CRYSTAL MATERIALS Final Technical Report, 1 Jan. 1968 - 31 Dec. 1969
Gerald L. Glen Mar. 1970 13 p refs
(Contract AF 49(638)-1670)
(AD-702820; AFOSR-70-0761TR) Avail: CFSTI CSCL 11/2

The report discusses techniques to study chemical properties in glass and glass-crystal materials. The optimum system turned out to be an x-ray line source with flat-crystal, divergent beam optics and a dual detector system to monitor the incident x-ray beam. This system was used to study K edges from Ti to Cu, albeit slightly modified to provide a helium atmosphere for the study of the lighter atoms. These data were of sufficient quality to be subjected to a theoretical analysis. The MO theory was extensively used in studies of many first-row transition metal compounds. Since no reliable x-ray absorption technique was developed for the study of light elements (Mg through Cl), an electron microprobe study as initiated for this purpose. TAB

N70-31522# Oak Ridge National Lab., Tenn.
GAMMA-ABSORPTION POROSIMETRIC STUDY OF PORE SIZES OF ARTIFICIALLY DENSIFIED GRAPHITE MODIFIED AS A RESULT OF NATURAL GAS CRACKING
L. Bochirol et al Mar. 1970 14 p refs Transl. into ENGLISH from Carbon (London), v. 6, 1968 p 649 - 660
(ORNL-TR-2297) Avail: CFSTI

A brief description is given of a new mercury porosimeter which uses gamma-beam absorption. This apparatus allows measurements of local heterogeneities in pore size distribution. It was used to study the changes in pore size distribution after deposition of a pyrocarbon inside the pores of conventional nuclear graphites. The deposits were obtained by thermal decomposition of natural gas under normal pressure and approximately 1000 C. The influence of main parameters such as the gas flow, hydrogen content, and initial pore size distribution was studied. Such modification of pore size distribution appears to be of interest in the reduction of the radiolytic corrosion of graphites in CO2. Author (NSA)

N70-31621# Naval Radiological Defense Lab., San Francisco, Calif.

PYROLYSIS PRODUCTS OF UNTREATED AND FLAME RETARDANT TREATED ALPHA-CELLULOSE AND LEVOGLUCOSAN Final Report

Frank A. Wodley Aug. 1969 43 p refs

(Contract DAHC20-67-C-0149)

(AD-704145) Avail: CFSTI CSCL 7/3

A typical gas chromatogram of the volatile pyrolysis products (molecular weights less than 150) of untreated alpha-cellulose contains 39 peaks, however, mass spectral data indicate that at least 59 compounds are present. Since the initial pyrolysis products undergo decomposition, both initial and subsequent decomposition products are included in the analysis. A comparison of the products generated in the temperature range 330 - 400C indicates that the formation of pyrolysis products is essentially independent of temperature. In general, flame retardant treated samples produce fewer products than untreated samples, although the compounds that are present are the same. Some treatments, including 4% iodination, 6% benzhydrylation, and 4% iodination-5% benzhydrylation yield only five prominent compounds: water, acetic acid, furfural, 5-methyl-2-furfuraldehyde, and an unknown. Flame retardant concentration seems to affect the formation of products more than the type of retardant. Comparisons of the chromatograms obtained for untreated levoglucosan and cellulose indicate that most of the decomposition of cellulose probably forms levoglucosan which then decomposes to yield the observed pyrolysis products.

Author (TAB)

N70-31657# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD FOR DETERMINING THE CRITICAL TEMPERATURE OF APPEARANCE OF A BOUNDARY LUBRICATING FILM

K. I. Klimov et al 21 Jan. 1970 12 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Inst. po Pererabotke Nefti (Moscow), no. 10, 1967 p 250 - 256

(AD-704043; FTD-HT-23-624-69) Avail: CFSTI CSCL 11/8

A new method for determining critical temperature (disorientation) of a boundary lubricant film is described. It is based on a method the reverse of that used previously, which starts from friction with a complete film, followed by transition to friction with a totally destroyed film. In the present method, friction at an unlubricated interface changes to surface friction. The four-ball friction machine designed by V. P. Paylov is used in the experiments. The friction coefficient is recorded by a photo-registering camera. The run is started with thoroughly rinsed, dry balls, followed by gradual lubrication. Graphic representation shows a sharp drop in friction coefficient at the point of boundary lubricant film formation. This drop becomes less sharp with rising test temperature and no jump is observed in the curve when the critical temperature is reached. The critical temperature for hydrocarbon lubricants is directly proportional to molecular weight and test product viscosity. An equation gives the relationship between average molecular weight and critical temperature. Prior methods give false results because the deteriorated lubricant film represents a different chemical composition than the starting material due to breakdown and oxidation.

Author (TAB)

N70-31687# Technische Hochschule Hannover (West Germany).

THIN LAYER CHROMATOGRAPHY OF ORGANIC PHOSPHOROUS COMPOUNDS USED AS ADDITIVES IN LUBRICATING OILS

[DUENNSCHICHTCHROMATOGRAPHIE VON ORGANISCHEN PHOSPHORVERBINDUNGEN, DIE ALS SCHMIEROELZUSAETZE VERWENDET WERDEN]

Egbert Bonewitz (Ph.D. Thesis) [1969] 108 p refs In GERMAN

Avail: CFSTI

Developed was a three-dimensional chromatographic method for separating the following organic phosphorous compound additives from mineral oils: triarylphosphate, trialkylphosphate, trialkylphosphite, triarylphosphinoxide, and zincdialkyldithiophosphate. A nonpolarizing solvent followed by aluminum oxide H layers and siliceous gel H chromatography was the basic method for extraction. Another group consisting of triarylphosphite, triarylphosphine, and trialkyldithiophosphate was separated from the first group of additives by reaction with benzole and further treatment with aluminum oxide-H-layer chromatography and iodine.

Transl. by GG

N70-31771# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MACHINES AND INSTRUMENTS FOR TESTING MATERIALS: COLLECTION OF ARTICLES FROM THE JOURNAL INDUSTRIAL LABORATORY

M. M. Tenebaum et al 21 Jan. 1970 29 p refs Transl. into ENGLISH from the Russian

(AD-704048; FTD-MT-24-323-69) Avail: CFSTI CSCL 11/7

Contents: Instrument for testing the wear resistance of materials; Testing the running-in and wear of antifriction materials; Investigation of friction and wear of materials in conditions of deep cold; and Machine for testing antifriction materials at raised slip rates.

TAB

N70-31786# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE THERMAL DEGRADATION OF COMMERCIAL ADDITIVES FOR LUBRICANTS AND FUEL OILS

V. Masek 2 Mar. 1970 12 p refs Transl. into ENGLISH from Ropa a Uhlie (Bratislava), v. 11, no. 1, 1969 p 26 - 30

(AD-703764; FTD-HT-23-55-70) Avail: CFSTI CSCL 11/8

Thermogravimetric analysis of 9 commercial additives showed that the mechanism of thermal degradation can be investigated by this method. The endothermic and exothermic reactions involved in degradation and the electrical properties are not found by the method.

TAB

N70-31790# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USE OF ELECTRICALLY CONDUCTING COATINGS OF COPPER SELENIDE AND COATINGS COMPOSED OF CU3PS(x) FOR PREPARING ELECTROLUMINESCENT CAPACITORS

B. P. Kryzhanovskii et al 25 Feb. 1970 12 p refs Transl. into ENGLISH from Svetotekhnika (USSR), v. 14, no. 7, 1968 p 3 - 6

(AD-703763; FTD-HT-23-22-70) Avail: CFSTI CSCL 9/1

Methods of applying electrically conducting coatings of copper selenide and coatings with a composition of Cu3PSx to organic glass and transparent polymer ribbons are discussed. Copper selenide coatings are produced by vacuum deposition of Cu2Se. Heating the object afterwards at 70-80C for 30-60 min improves transparency and electrical conductivity. A coating of Cu3PSx is formed by vacuum vaporization of phosphorus powder, which was first fused onto tungsten or tantalum ribbons. Afterwords it is necessary to work the substance in sulfur vapor to increase the transparency and stability of the coating. Transmission characteristics of this coating are similar to those of the Cu2Se coating. A detailed explanation is given of the methods used to manufacture specimens of electroluminescent capacitors with these coatings on organic glass. All steps of the process, including deposition of the coating, protective coatings, adhesion of the electrical contacts and hermetic sealing, are presented.

TAB

N70-31828*# Naval Ordnance Lab., White Oak, Md.

PROPERTIES OF GRAPHITE FIBER COMPOSITES AT CRYOGENIC TEMPERATURES, JUNE 1967 - AUGUST 1969

Robert A. Simon and Richard Alfring 13 May 1970 96 p refs
(NASA Order C-10360B)
(NASA-CR-72652; NOLTR-69-183) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740

Need for low-weight, cryogenic pressure vessels for spacecraft resulted in an investigation to measure graphite fiber composite properties at cryogenic temperatures. An investigation of mechanical properties of several fibers and resins as composite strands, bars, and rings showed that composite moduli increased by 0 to 20% at −195 C, and composite tensile strengths decreased by 0 to 30%. Bending fatigue at 50% breaking stress and 1000 cycles deteriorated rings less when cold than when at room temperature. Thermal contraction tests of composites showed the graphite fibers to have a slight negative coefficient. Combined with resins in composites, the resin matrix would experience up to 1.5% strain when cold due to its thermal contraction. A second part of the investigation involved the design, fabrication, and testing of graphite filament wound pressure vessels. Vessel ultimate strains of 0.2 to 0.5% were found, which are generally compatible with the stainless steel liners used or with other candidate liner materials. The pressure vessel performance factor of PV/W showed the graphite vessels to be competitive with boron and two-thirds as high as fiberglass. Author

N70-31858# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE APPLICATION INKhP-20 ADDITIVE IN PRODUCING AN ALL-SEASON TRANSMISSIONAL OIL
A. M. Kuliev et al 9 Jan. 1970 8 p Transl. into ENGLISH Prisadki k Smazochnym Maslam (Baku), 1967 p 164 - 166
(AD-704165; FTD-MT-24-417-69) Avail: CFSTI CSCL 11/8

On a isobutyl copolymer base with stylene additive an all-season transmissional oil was formulated with a solidification point of minus 30 degrees centigrade and a viscosity of 15 cSt at 100 degrees centigrade, and having an index of viscosity of 87.7. The formulated all-season transmissional oil was tested on a de-polymerizing apparatus and also on a stand with gearboxes of an automobile engine. TAB

N70-31888# Massachusetts Inst. of Tech., Cambridge.
RESEARCH IN MATERIALS Annual Report, 1969 - 1970
Apr. 1970 417 p refs
(Contracts DA-28-043-AMC-01978(E); ARPA SD-90)
(AD-703630) Avail: CFSTI CSCL 20/12

The work is grouped under the following section headings: Chemical and solid state physics; Electrical, magnetic, and optical properties of materials and application to devices; Metallurgy and ††materials science; Materials engineering. USGRDR

N70-31944*# National Materials Advisory Board, Washington, D.C. Committee on Coatings.
HIGH TEMPERATURE OXIDATION RESISTANT COATINGS
Mar. 1970 67 p
(Contract NSR-09-012-910)
(NASA-CR-110452; NMAB-263) Avail: CFSTI CSCL 11C

Coatings for superalloys, refractory metals, and graphite are described from the points of view of fundamental principles, specific substrate, and application. This report constitutes a summary of a larger volume which describes these areas in detail. General and specific conclusions were reached, followed by recommendations for upgrading coating capabilities. Author

N70-32000# Aerospace Corp., El Segundo, Calif. Materials Science Lab.
OBSERVATIONS ON A NEW ALLOTROPIC FORM OF CARBON, JANUARY - MAY 1969
A. Greenville Whittaker and Paul L. Kintner 31 Jul. 1969 18 p refs
(Contract F04701-69-C-0066)
(AD-704117; TR-0066(5250-40)-5; SAMSO-TR-70-112) Avail: CFSTI CSCL 20/2

New information on the recently characterized white allotropic form of carbon is reported. White carbon was produced in high-temperature, low-pressure experiments on graphite sublimator and was characterized by its crystallographic interplaner spacings. Under free vaporization conditions above about 2550K, the white carbon forms as small transparent crystals on the edges of the basal planes of graphite. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-30641# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TABLES FOR THE BIVARIATE (T) DISTRIBUTION Final Report
P. R. Krishnaiah Dec. 1969 47 p refs
(AD-702810; ARL-69-0210) Avail: CFSTI CSCL 12/1

Let x sub 1 and x sub 2 be jointly distributed as a bivariate normal with a common unknown variance sigma squared, known correlation rho, and zero means. Also, let t sub i = (x sub i)(the square root of n)/s, (i = 1,2), where s squared/sigma squared is distributed, independent of x sub 1 and x sub 2, as a chi-square variate with n degrees of freedom. In this paper, we give the values of (1-alpha) to six decimal accuracy for n = 5(1)35, the absolute value of rho = 0(0.1)0.9, a = 1.0(0.1)5.5 where alpha is given by P((the absolute value of t sub 1) < a, (the absolute value of t sub 2) < a) = (1-alpha). Author (TAB)

N70-30646# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
CHARACTERISTIC EXPONENTS AT L4 IN THE ELLIPTIC RESTRICTED PROBLEM
Andre Deprit and Arnold Rom Dec. 1969 33 p refs *Its* Mathematical Note 642
(AD-703008; D1-82-0957) Avail: CFSTI CSCL 3/3

The systems considered here are Hamiltonian, linear with periodic coefficients and depending on a small parameter. A perturbation method based on Lie transforms is proposed to develop the characteristic exponents of the monodromy matrix in power series of the small parameter. The algorithm is applied to the triangular Lagrangian solutions in the elliptic restricted problem. The principal parts of their characteristic exponents have been obtained in literal form as irrational functions of the mass ratio. The actual calculation has been automated by means of a package of subroutines cpded to process Echeloned Series. The strong stability of the Lagrangian solutions is discussed in relation to the eccentricity of the primaries. Author (TAB)

N70-30667# Illinois Univ., Urbana. Dept. of Computer Science.
ORTHOGONALITY RELATIONS FOR CHEBYSHEV POLYNOMIALS
M. K. Jain and M. M. Chawla Jan. 1970 22 p refs
(Contract AT(11-1)-1469)
(COO-1469-154; Rept-373) Avail: CFSTI

Two new discrete point orthogonality relations for the Chebyshev polynomials of the first kind were obtained. Semi-closed Gauss-Chebyshev quadrature formulas, required for the purpose of obtaining these relations, were developed. These orthogonality relations lead to better approximations to the coefficients in the,

Chebyshev-Fourier expansion of a function and consequently to better values for an integral when the integrand is approximated by a truncated Chebyshev-Fourier series. Author

N70-30685# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
21 Apr. 1970 15 p refs Transl. into ENGLISH from Russian journals
(JPRS-50359) Avail: CFSTI

CONTENTS:

1. ESTIMATING CLOSENESS OF STATISTICAL CHARACTERISTICS OF LINEAR, NONSTATIONARY AUTOMATIC CONTROL SYSTEMS OF A SINGLE CLASS V. A. Kiselev p 1-6 refs (See N70-30686 16-19)

2. THEORY OF BIFURCATION OF POINT TRANSFORMATIONS E. V. Gaushus p 7-12 refs (See N70-30687 16-19)

N70-30686# Joint Publications Research Service, Washington, D.C.
ESTIMATING CLOSENESS OF STATISTICAL CHARACTERISTICS OF LINEAR, NONSTATIONARY AUTOMATIC CONTROL SYSTEMS OF A SINGLE CLASS
V. A. Kiselev *In its* Cybernetics and Regulation Theory 21 Apr. 1970 p 1-6 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 190, no. 6, 1970 p 1292-1295 (See N70-30685 15-19)
Avail: CFSTI

A discussion of linear nonstationary automatic control systems comprising a stationary link with a rational transfer function and closed feedback with an amplification coefficient inversely proportional to the linear time function is presented. These systems are described by a linear differential equation of the Laplace type with real constants. Author

N70-30687# Joint Publications Research Service, Washington, D.C.
THEORY OF BIFURCATION OF POINT TRANSFORMATIONS
E. V. Gaushus *In its* Cybernetics and Regulation Theory 21 Apr. 1970 p 7-12 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 191, no. 1, 1970 p 43-46 (See N70-30685 16-17)
Avail: CFSTI

Point transformations with a polynomial sequence function are investigated with the aid of parametric diagrams. Natural and even bifurcations are discussed in terms of the possible types of internal bifurcations of one dimensional point transformations. The cycles of even multiplicities are then generated as a result of bifurcations of both types, and cycles of odd multiplicities, only by natural bifurcations. J.M.C.

N70-30805*# Pittsburgh Univ., Pa. Space Research Coordination Center.
AN IMPROVED GENERALIZED INVERSE ALGORITHM FOR LINEAR INEQUALITIES AND ITS APPLICATIONS
L. C. Geary and C. C. Li 11 Mar. 1970 22 p refs
(Grant NGL-39-011-002)
(NASA-CR-110433; SRCC-122) Avail: CFSTI CSCL 12A

CONTENTS:

1. AN IMPROVED GENERALIZED INVERSE ALGORITHM FOR LINEAR INEQUALITIES AND ITS APPLICATIONS L. C. Geary and C. C. Li p 1-14 refs (See N70-30806 16-19)

2. ON AN IMPROVED GENERALIZED INVERSE ALGORITHM FOR LINEAR INEQUALITIES L. C. Geary and C. C. Li p 15-18 refs (See N70-30807 16-19)

N70-30806*# Pittsburgh Univ., Pa. Space Research Coordination Center.
AN IMPROVED GENERALIZED INVERSE ALGORITHM FOR LINEAR INEQUALITIES AND ITS APPLICATIONS
In its An Improved Generalized Inverse Algorithm for Linear Inequalities and its Appl. 11 Mar. 1970 p 1-14 refs Presented at the 1970 Spring Joint Computer Conf., Atlantic City, 5-7 May 1970 (See N70-30805 16-19)
Avail: CFSTI CSCL 12A

An iterative algorithm is developed for the solution of the set of linear inequalities which is written by $Aw > 0$. The proposed two-class algorithm has a higher rate of convergence than previous methods for a certain range of initial vectors. For problems where a large number of iterations, for example greater than 20, were required for a previously developed algorithm, the proposed algorithm reduced this number of iterations by a factor of 20 or more. Even though the cost per iteration is 10% to 20% greater, the total cost is reduced. For problems where less than 20 iterations were previously required, the algorithm reduced the number of iterations by as much as 30%. Author

N70-30807*# Pittsburgh Univ., Pa. Space Research Coordination Center.
ON AN IMPROVED GENERALIZED INVERSE ALGORITHM FOR LINEAR INEQUALITIES
In its An Improved Generalized Inverse Algorithm for Linear Inequalities and its Appl. 11 Mar. 1970 p 15-18 refs Presented at the 3rd Hawaii Intern. Conf. on System Sci., Honolulu, Hawaii, 14-16 Jan. 1970 (See N70-30805 16-19)
Avail: CFSTI CSCL 12A

A brief summary is presented of the previous paper on an improved generalized inverse algorithm for linear inequalities and its applications. N.E.N.

N70-30930# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
APPROXIMATION BY CUBIC SPLINE WITH RESPECT TO EUCLIDEAN NORM
Palmer R. Schlegel Jan. 1970 18 p refs
(AD-700973; BRL-1465) Avail: CFSTI CSCL 12/1

The use of a cubic spline function for an interpolation procedure has produced very good results in approximation of derivatives of functions represented by smooth data. If one attempts to construct a cubic spline function for a set of data which contains round off error, this property may be lost. In this paper a smoothing procedure is developed by finding the best cubic spline function, that is, over the class of cubic spline functions, we will determine the one which minimizes the Euclidean norm. Author (TAB)

N70-30935*# Maryland Univ., College Park. Computer Science Center.
DIFFERENCE EQUATIONS AND ITERATIVE PROCESSES
Raymond C. Cavanagh Feb. 1970 130 p refs
(Grants NGL-21-002-008; NSF GJ-231)
(NASA-CR-110446; TR-70-108) Avail: CFSTI CSCL 12A

The various techniques used in proving convergence of iterative processes for solving systems of (nonlinear) equations in real or complex fields are extended, clarified, and unified. The topics discussed are (1) the principle leading to the generation of suitable one- or multidimensional difference equations for proving convergence of iterative methods, (2) the analysis of certain types of solutions of the difference equations arising from (1), and (3) the application of the results from (2) to convergence proofs for

various typical classes of iterative processes. A general theory which includes these special cases and which promises to lead to new results is presented. Author

N70-30947*# Translations Consultants, Ltd., Arlington, Va.
ON INTEGRATION OF A CLASS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS BY DEFINITE INTEGRALS [UEBER DIE INTEGRATION DURCH BESTIMMTE INTEGRALE VON EINER KLASSE LINEARER PARTIELLER DIFFERENTIALGLEICHUNGEN]
Sophus Lie Washington NASA Jun. 1970 33 p Transl. into ENGLISH from Ges. Abhandl. (Leipzig), v. 3, 1922 p 492-524
(Contract NASw-2038)
(NASA-TT-F-13030) Avail: CFSTI CSCL 12A

A complete transformational theory is presented of all linear and homogeneous partial differential equations of the second order with two independent and one dependent variable. All equations of this type permit an unlimited number of transformations. In most types of transformation, x and y remain invariable. There are, however, a few classes of such equations which also permit transformations in which both x and y can be transformed. The equations discussed can generally not be integrated using the Laplace method. On the other hand, it is normally possible to establish a particular integral with two arbitrarily selected constants. These constants are not linear, and thus it is easy to find an integral with two arbitrary functions which occur in partial integrals. In order to integrate, it is by no means necessary to write the equation in its canonical form. Thus, if a linear partial differential equation of the second order permits an infinitesimal transformation of z, x, y, in which x and y are changed, then it is always possible to establish an integral with arbitrary functions by integrating common differential equations. Author

N70-30949# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
CONVEXITY PRESERVING SCALE TRANSFORMATIONS
Albert W. Marshall and Frank Proschan Dec. 1969 21 p refs *Its* Mathematical Note 640
(AD-701156; D1-82-0949) Avail: CFSTI CSCL 12/1

Let C be the class of increasing convex functions on the interval from zero to (but less than) infinity with f(0) = 0. Then f epsilon C implies that the composition (psi)f(psi superscript-1) epsilon C if and only if psi(x) = c(x to the power p), c > 0, p = or > 1. Functions psi for which (psi)f(psi superscript-1) epsilon C whenever f epsilon C are characterized for various other classes C, e.g., the concave, starshaped or superadditive increasing functions f on the interval from zero to (but less than) infinity with f(0) = 0. In addition, classes of functions on other domains, and logarithmically convex or concave functions are also considered. Author (TAB)

N70-30997*# Brown Univ., Providence, R.I.
SMOOTHNESS OF SOLUTIONS OF VOLTERRA INTEGRAL EQUATIONS WITH WEAKLY SINGULAR KERNELS
Richard K. Miller and Alan Feldstein (Virginia Univ.) [1970] 34 p refs
(Grants NGL-40-002-015; AF-AFOSR-0693-67A)
(NASA-CR-110444) Avail: CFSTI CSCL 12A

Some results are obtained on the differentiability properties of solutions of nonlinear integral equations of the form x(t) = f(t) + integral super t sub 0 a(t-s)g(s,x(s))ds (0 ≤ t ≤ T). The general problem of determining the smoothness of solutions of the equation is rather complex. Such results are necessary in order to estimate the error in numerical approximations of the solution of the equation. This type of result is also useful in proving the equivalence of certain nonlinear boundary value problems for the heat equation with a corresponding Volterra system. It is expected that as f and g become smoother the solution of the equation must become smoother. This is true to some extent but intuition should not be trusted too far. Author

N70-31017# Cornell Univ., Ithaca, N.Y. Center for Applied Mathematics.
ON THE BOUNDEDNESS OF AN ITERATIVE PROCEDURE FOR SOLVING A SYSTEM OF LINEAR INEQUALITIES
H. D. Block and S. A. Levin Dec. 1969 16 p refs
(Grants AF-AFOSR-1402-688; AF-AFOSR-1472-68)
(AD-702780; AFOSR-70-0522TR) Avail: CFSTI CSCL 12/1

It is proved that the perceptron error-correction procedure stays bounded, even when no solution to the system of linear inequalities exists. This supplements earlier papers by B. Efron and M. Minsky and S. Paperi. Author (TAB)

N70-31027*# Maryland Univ., College Park. Computer Science Center.
GENERALIZED RAYLEIGH METHODS WITH APPLICATIONS TO FINDING EIGENVALUES OF LARGE MATRICES
James S. Vandergraft Jan. 1970 24 p refs
(Grant NGL-21-002-008)
(NASA-CR-110448; TR-70-105) Avail: CFSTI CSCL 12A

If X is an approximation to an eigenvector of an n x n symmetric matrix A, the Rayleigh quotient is an approximation to an eigenvalue of A. The generalization of the concept involves construction of a p x p matrix B, where usually p << n. The eigenvalues of B are used to approximate the eigenvalues of A. The eigenvalues and eigenvectors determined by a matrix A and a subspace H are defined and a quantity is considered which provides a measure of how nearly invariant H is with respect to A. Using this measure error bounds are derived for the approximate eigenvalues and eigenvectors. Two methods are discussed for finding subspaces which are nearly invariant and which give good approximations. Author

N70-31157# Rome Univ. (Italy). School of Aerospace Engineering.
CALCULATION OF IMPROPER INTEGRALS [CALCOLO DI INTEGRALI IMPROPRI]
P. Santini Dec. 1969 14 p refs In ITALIAN *Its* Quaderni di Calcolo Elettronico No. 1
Avail: CFSTI

The singularity method is applied to differential equations for calculating integrals that cannot be determined by the Newton-Cotes formula. Expressions for truncation errors are derived, and examples of the applications are presented. Transl. by F.O.S.

N70-31158# Rome Univ. (Italy). School of Aerospace Engineering.
ONE-DIMENSIONAL PANEL FLUTTER WITH EQUATIONS FOR NONLINEAR BOUNDARY CONDITIONS [PANEL FLUTTER UNIDIMENSIONALE CON EQUAZIONE E CONDIZIONI AL CONTORNO NON LINEARI]
L. Morino Dec. 1969 33 p In ITALIAN *Its* Quaderni di Calcolo Elettronico No. 5
Avail: CFSTI

The problem of panel flutter in a semi-infinite plate with nonlinear boundaries is studied considering nonlinear aerodynamics and curvature. The analytical solution is determined to the third order. A numerical application with varying plate rigidity, and dynamic pressure is presented. F.O.S.

N70-31160# Minnesota Univ., Minneapolis.
AN ASYMPTOTIC COMPARISON OF SUBSET SELECTION PROCEDURES
Milton Sobel and S. P. Yen [1970] 6 p refs
(Grant NSF GP-9018)
(TR-118) Avail: Issuing Activity

A procedure R for selecting a subset of k populations containing at least one of the t best populations is considered. A special case is discussed where t = 1 and delta* = 0, and asymptotic comparisons are made of given subsets for any k-vector theta of true parameter values. Normal populations with a common variance, taken to be unity, are assumed. R.B.

N70-31175# Los Alamos Scientific Lab., N. Mex.
A HISTORY-DEPENDENT RANDOM SEQUENCE DEFINED BY Ulam
M. Kac (Rockefeller Univ.) 3 Mar. 1970 4 p ref
(Contract W-7405-eng-36)
(LA-4289) Avail: CFSTI

Ulam has defined a history-dependent random sequence of integers (a sub n) by the recursion a sub(n + 1) = a sub n + a sub x(n), a sub 1 = 1, P(X(n) = K) = 1/n, and K = 1,2,...,n. It is shown that the expectation of a sub n is asymptotic to exp(2 square root n) and that the expectation of a-2 sub n is asymptotic. The methods of generating functions and steepest descent are used. Author

N70-31186*# Cooper (Paul W.), Cambridge, Mass.
THEORETICAL INVESTIGATION OF UNSUPERVISED LEARNING TECHNIQUES Final Report
Paul W. Cooper 19 Jun. 1970 102 p refs
(Contract NAS12-697)
(NASA-CR-110453) Avail: CFSTI CSCL 12A

The larger portion of the study provides theoretical analysis of the Haralick - Darling technique. The decision procedure, behavioral properties based upon incremental per cycle analysis and decision constraints, and convergence analysis are examined. A hill is defined over the complete space spanned by the vectors of the classification algorithm for the model used to represent the technique. It is shown that the technique climbs the hill, eventually reaching limits. Nonchanging decisions per cycle are shown to lead to stable partitions of the dataset, and changing decisions are shown to involve bounds, which are derived. The second topic is an extension of earlier work on nonsupervised learning for a formal statistical model where moment estimators are used. Higher-order product moment matrices are utilized in solving the association problem. Particular use is made of the product moments which are first-order in one of the variates, as these allow for use of linear equations in solving for the desired parameters and their associations with one another. Treated specifically are 2-category and M-category cases for underlying multivariate normal distributions, although the procedures apply generally. Author

N70-31316# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A DUAL DECOMPOSITION ALGORITHM FOR SOLVING MIXED INTEGER-CONTINUOUS QUADRATIC PROGRAMMING PROBLEMS
John A. Muckstadt Nov. 1969 17 p refs
(AD-702813; SLTR-7-69; AFIT-TR-7) Avail: CFSTI CSCL 12/2

The report contains a presentation of an algorithm for solving the following mixed integer-continuous mathematical programming problem: min((g super Ty + (c superscript T)x + 1/2 (x superscript T)Dx: (Ax + By) > or = b, y is an element of S, x > or = 0) where g, c, x, y, and b are column vectors of appropriate dimension; A, B, and D are matrices of appropriate dimension; and S is a closed bounded set whose elements have integer components. The quadratic form is assumed to be positive semi-definite. The algorithm is a generalization of one developed by J. F. Benders for solving the above problem for the special case where D = 0. The primary motivation for developing this algorithm was a desire to construct a method for solving both an aircraft maintenance scheduling problem and the unit commitment - economic dispatch scheduling problem encountered in large scale power systems. Author (TAB)

N70-31317# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN APPLICATION OF DUALITY THEORY TO ZERO-ONE INTEGER PROGRAMS HAVING CONVEX OBJECTIVE FUNCTIONS
John A. Muckstadt Oct. 1969 27 p refs
(AD-702811; SLTR-6-69; AFIT-TR-6) Avail: CFSTI CSCL 12/2

The report contains a discussion of a zero-one integer programming algorithm for solving the following problem: min (f(x): (b + Ax) > or = 0, (x sub j) = 0 or 1) where f(x) is a differentiable convex function, b is an m-vector, x is an n-vector and A is an mxn matrix. The algorithm is a generalization of one developed by Geoffrion for solving the above problem when f(x) is linear. The basic motivation for performing this research was a desire to construct an algorithm for solving an aircraft maintenance scheduling problem. Limited experimental experience is reported. The results of the tests indicate solution times increase approximately quadratically as a function of increasing the number of integer variables in the problem structure. Author (TAB)

N70-31366*# Brown Univ., Providence, R.I.
ERROR BOUNDS FOR COMPOUND QUADRATURE OF WEAKLY SINGULAR INTEGRALS
Alan Feldstein (Arizona State Univ.) and Richard K. Miller [1970] 30 p refs Sponsored in part by AEC
(Grants NGL-40-002-015; AF-AFOSR-0693-67A)
(NASA-CR-110440) Avail: CFSTI CSCL 12A

Practical numerical methods for handling weakly singular quadratures are developed and analyzed. This development is extended to the case where some derivatives of the Lebesgue integrable have finitely many bounded points on the improper integral. The Minkowski inequality and Peano theorem are applied in this analysis. J.M.C.

N70-31369*# Texas A&M Univ., College Station. Inst. of Statistics.
ESTIMATION OF THE MEAN OF A DISCRETE PARAMETER, COVARIANCE STATIONARY, STOCHASTIC PROCESS IN ROTATION SAMPLING
Kin-Ya Nishikawa and W. B. Smith May 1970 54 p refs
(Grant NGR-44-001-097)
(NASA-CR-110438; TR-4) Avail: CFSTI CSCL 12A

The classical minimum variance unbiased linear estimator of the population mean in rotation sampling is invariant under alterations of the rotation scheme. A constrained optimization procedure is used to derive similar simultaneous linear equations. An earlier author considered this technique but rejected it because of the lengthy estimator expressions; however, by introducing matrix expressions and assuming a special rotation scheme this technique is found to be tractible. An alternative way for deriving the estimator is given. The procedure shows that: (1) exact expression for the population mean estimator can be found for each occasion; (2) the matrix notation leads to easier computer programming; and (3) the derivation of the exact expression of the variance-covariance matrix leads to ease in investigating the large sample properties of the estimators and their relation to maximum likelihood. Author

N70-31378# Naval Research Lab., Washington, D.C. Transducer Branch.
A DOUBLE PRECISION FORTRAN SUBROUTINE TO EVALUATE THE ASSOCIATED LEGENDRE FUNCTIONS OF THE FIRST KIND FOR REAL AND IMAGINARY ARGUMENTS Final Report
Robert L. Berkowitz and A. L. Van Buren Aug. 1969 23 p refs *Its* Computer Bull. 16
(AD-702733; NRL-MR-2086) Avail: CFSTI CSCL 12/1

The Fortran subroutine calculates, for a fixed argument X and a fixed order M, the associated Legendre functions of the first kind (P sub O, superscript M)(x),...,(P sub K, superscript M)(x), where the argument X is either real or pure imaginary, and the integer K is the highest degree desired. Author (TAB)

N70-31462# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
OPTIMAL CONTROL OF RESEARCH AND DEVELOPMENT EXPENDITURES
Carl W. Hamilton Dec. 1969 131 p refs
(Contract DA-31-124-ARO(D)-209)
(AD-702918; TR-48; AROD-968-57-M) Avail: CFSTI CSCL 12/2

A mathematical model is developed to assist the selection and funding of technology projects. The model assigns gamma distributions to the uncertain costs, represents the mission-technology dependencies by parallel-series networks, and considers a weighted sum of mission readiness probabilities as the overall objective. Optimization requires the solution of a mathematical program with a nonconcave objective function and linear constraints. In the single period case, a branch and bound algorithm is developed to find the globally optimal allocation. In the multiperiod case a complete solution can be determined when all costs are exponentially distributed. As the number of projects increase and the planning period lengthens, special decomposition techniques are required and are developed from the theory of discrete optimal control. Author (TAB)

N70-31466# Miami Univ., Coral Gables, Fla. Dept. of Mathematics.
INTERPOLATION WITH POLYNOMIALS TO BOUNDARY VALUES Final Scientific Report
H. Curtiss 15 Dec. 1969 7 p refs
(Grant AF-AFOSR-1525-68)
(AD-702822; AFOSR-70-0594TR) Avail: CFSTI CSCL 12/1

The report reviews work that appear in the following papers: Transfinite diameter and harmonic polynomial interpolation; Faber polynomials and the Faber series; Complex Lagrange interpolation on a Jordan curve with cusps; Divergence of interpolation polynomials in the complex domain; Existence of Liouville numbers. TAB

N70-31469# Louisiana State Univ., Baton Rouge.
DIGITAL CONTROL OF PROCESSES
Armando Benito Corripio (Ph.D. Thesis) Jan. 1969 213 p refs
(Contract F44620-68-C-0021)
(AD-702872; AFOSR-70-0729TR) Avail: CFSTI CSCL 12/1

The dissertation presents the frequency response of closed-loop digital control systems that use conventional digital control algorithms. In particular, proportional-plus-integral (PI), proportional-plus-integral-plus-derivative (PID), deadbeat, and nonminimal algorithms are investigated. The plant is approximated by a first order lag plus dead-time and the forcing function is a sinusoidal signal on the feedback path. The results are presented in the form of plots of the ratio of the amplitude of the controlled variable to the amplitude of the input signal versus frequency. These plots show a maximum amplitude ratio at low frequencies of the input signal by the inability of the sampler to differentiate between signals that differ in frequency by an interger times the sampling frequency. In order to reduce this error, a low pass filter is proposed to attenuate high frequency disturbances before they reach the sampler. A study of the effect of the filter on the amplitude ratio plots indicates that a filter time constant of one half the sampling frequency yields the best filter design. Of the control algorithms investigated, the PI and PID algorithms with minimum ITAE parameters produce the lowest amplitude ratio at the resonance peak. Author (TAB)

N70-31482 National Lending Library for Science and Technology, Boston Spa (England).
AN OBJECTIVE ANALYSIS BASED ON THE APPROXIMATION OF FIELDS BY POLYNOMIALS
A. A. Petrov 28 Nov. 1969 24 p refs Transl. into ENGLISH from Glav. Uprav. Gidromet. Sluzh., Met. Gidr. (Leningrad), no. 6, 1968 p 21-28 In ENGLISH and RUSSIAN
(NLL-M-7945-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The possibilities are examined of objective analysis by means of polynomials to approximate fields using the theory of estimation of linear forms from indirectly measured parameters. The accuracy of such interpolations is given for a number of examples of distributions of observations and types of polynomials. Author

N70-31487# Sandia Corp., Albuquerque, N. Mex.
[BASIC PROGRAM FOR QUALITY CONTROL STATISTICS WITH OPTIONS]
L. E. Snodgrass [1970] 36 p ref Sponsored by AEC
(SC-DC-70-4736) Avail: CFSTI

This program calculates and prints differences in paired observation entries through the simple modification of the Basic Program described in the logic diagram. The usual summary statistics are provided, along with the average difference, the calculated t value, and the standard deviation of the differences. Author

N70-31492# Liege Univ. (Belgium).
RESEARCH IN HYPERBOLIC DIFFERENTIAL EQUATIONS Final Report, 1 Apr. 1969 - 30 Jan. 1970
Florent J. Bureau 30 Jan. 1970 11 p
(Contract AF 61(052)-918)
(AD-702818; AFOSR-70-0760TR) Avail: CFSTI CSCL 12/1

The report contains conclusions of investigations on: (1) The Cauchy problem for partial differential equations of order n greater than 2 and p greater than 2 independent variables; (b) Boundary value problems for totally hyperbolic equations in several independent variables; (3) Problems suggested by and related to the above areas. Author (TAB)

N70-31524# Illinois Univ., Urbana. Dept. of Computer Science.
LINE AND AREA ORTHOGONALITY OF JACOBI POLYNOMIALS
M. M. Chawla and M. K. Jain Dec. 1969 12 p refs
(Contract AT(11-1)-1469)
(COO-1469-150; Rept-369) Avail: CFSTI

The complex Jacobi polynomials P sub n to the (alpha, beta) (z) are shown to form an orthogonal system on Epsilon sub rho with respect to a line integral inner product equation with a certain weight; further for certain alphas and betas, these polynomials also form an orthogonal system on class of functions in the interior of Epsilon sub rho with respect to the area integral inner product. Author

N70-31558# Michigan State Univ., East Lansing. Div. of Engineering Research.

DATA REDUCTION WITH GROUPING AND WEIBULL MODELS Interim Scientific Report
Richard C. Dubes 30 Jan. 1970 73 p refs
(Grant AF-AFOSR-1023-67)
(AD-702856; AFOSR-70-0715TR; SR-7) Avail: CFSTI CSCL 12/1

The computational details are given for a two-step procedure for condensing size-graded data, especially bio-medical data, into a parametric statistical model. The first step establishes a histogram of size density while the second fits a Weibull model to the histogram. Three types of histograms are defined and compared on the basis of computational efficiency. An algorithm is proposed for simultaneously estimating the scale, shape, and location parameters of a Weibull distribution from a histogram, and figures of merit for the Weibull fit are defined. The Weibull model is shown to be more flexible than an Edgeworth model. Examples are provided based on computer-simulated data and electroencephalographic (EEG) data. One example classifies EEG sleep data according to sleep stage with the shape parameter of a Weibull fit to a frequency histogram. Author (TAB)

N70-31562# Naval Research Lab., Washington, D.C. Mathematics Research Center.
ENTIRE FUNCTIONS OF EXPONENTIAL TYPE
Fred Gross 31 Dec. 1969 9 p refs
(AD-704092; NRL-6973; Rept-69-2) Avail: CFSTI CSCL 12/1

An entire function satisfying an integer and a constant was shown to be of exponential type. An inequality was satisfied using an entire function of periodic exponential type. The maximum modulus and the analogous condition are also reviewed. J.A.M.

N70-31623# Naval Ship Research and Development Center, Washington, D.C.
THE CONVERGING FACTOR FOR THE MODIFIED BESSEL FUNCTION OF THE SECOND KIND Interim Report
John W. Wrench, Jr. Jan. 1970 60 p refs
(AD-704098; NSRDC-3268) Avail: CFSTI CSCL 12/1

The converging factor for a specific mathematical function, such as the modified Bessel function of the second kind considered in this report, is that factor by which the last term of a truncated series (usually asymptotic) approximating the function must be multiplied to compensate for the omitted terms. This converging factor for the aforementioned Bessel function is discussed herein in detail and is shown to be related to the corresponding factor for the probability integral. Tables of this factor and its reduced derivatives, correct to 30 decimal places, are included to expedite the application of this procedure to the evaluation of this Bessel function to high precision for arguments between 5 and 20, and specific examples of such applications are presented. Author (TAB)

N70-31651 Univ. of Southern Calif., Los Angeles.
IMPLICIT FUNCTIONS IN LOCALLY CONVEX SPACES
Terrence Stephen McDermott (Ph.D. Thesis) 1969 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-17886

Let X and Z be Hausdorff locally convex real linear topological spaces, Y an arbitrary topological space, N an open subset of X. A general mapping theorem is discussed giving conditions under which a mapping f:N approaches the limit of Z, linearly approximable in a certain sense on a neighborhood U of x sub o epsilon N, will have the property that f(U) contains a neighborhood of f(x sub 0). Utilizing this result, an open mapping theorem and results concerning the local inversion of f are established. An implicit function theorem is established guaranteeing, under appropriate hypotheses, that the equation F(y,x) = 0 will have a solution x(y) in a neighborhood of y sub o epsilon Y, where f(y sub o,0) = 0 and f:K × N approaches the limit of Z, K open in Y. The continuity, uniqueness, and differentiability of solutions are discussed and conditions obtained guaranteeing each of the three properties. The implicit function theorem is applied to the problem of global existence of continuous solutions for the nonlinear Volterra integral equation. Dissert. Abstr.

N70-31676 Louisiana State Univ., Baton Rouge.
SOME REMARKS ON INTEGRAL DEPENDENCE AND NOETHERIAN RINGS
Paul M. Eakin, Jr. (Ph.D. Thesis) 1968 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-4465

The following problem is considered: Given a ring R and a family gamma of noetherian overrings of R, what conditions on the family gamma will assure that R is noetherian? The main result is that R is noetherian if gamma contains a ring which is finitely generated and integral over R. Some of the examples show that a number of conditions on gamma are not sufficient to imply that R is noetherian. Examples of non-noetherian, finite dimensional Krull rings are given. The two dimensional example provides a finite dimensional Krull ring which is not the derived normal ring of a noetherian domain. Dissert. Abstr.

N70-31679 Auburn Univ., Ala.
ON THE RELATION BETWEEN A SEMIGROUP AND ITS SQUARE
Reginald Merle Mazeres (Ph.D. Thesis) 1969 45 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-18639

The definition of an inflation of a semigroup is generalized to one-sided enlargements and enlargements of semigroups. Examples are given of a semigroup that is a one-sided enlargement but not an enlargement and of a semigroup that is an enlargement but not an inflation. Some theorems are proved on general semigroups. If S is a semigroup such that its square is the union of disjoint groups then the given theorems are proved. Dissert. Abstr.

N70-31680 California Inst. of Tech., Pasadena.
A STUDY OF RANK FOUR PERMUTATION GROUPS
James Thomas Renfrow (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilm: HC $4.20/Microfilm $3.00 Order No. 69-19594

A rank 4 group is a finite transitive permutation group acting on a set Omega such that the subgroup fixing a letter breaks up Omega into 4 orbits. Intersection matrices are used to obtain relations between the lengths of the four orbits associated with a rank 4 representation and the degrees of the irreducible characters in the permutation character of the representation. It is shown that two orbits of the representation are paired if and only if two of the characters are complex conjugates of one another. All the maximal primitive rank 4 groups are determined. Techniques are developed, using intersection matrices, to find all rank 4 representations of known finite groups. Group theoretic results about possible rank 4 groups are derived from the intersection matrices which would have to correspond to the rank 4 representation. Dissert. Abstr.

N70-31683 Texas Christian Univ., Fort Worth.
VALUE DETERMINING SETS AND BASES OF KERNELS FOR A FUNCTIONAL HILBERT SPACE
David Lee Drennan (Ph.D. Thesis) 1968 34 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6598

If H sub D is a Hilbert space of functions defined on a set D, H sub D is a functional Hilbert space provided H sub D possesses a reproducing kernel for every point in D, i.e., for every w in D, there exists a unique function K sub w in H sub D such

that (f.K to the power of w) = f(w) for every f in H sub D. A value determining set for H sub D is a subset N of D such that the only function in H sub D which takes the value zero at each point of N is the zero function. The first result is concerned with a relationship between value determining sets for a functional Hilbert space and the reproducing kernel functions in the space. By using the results stated it is possible to obtain results which answer certain interpolation problems. Dissert. Abstr.

N70-31684 Florida State Univ., Tallahassee.
T-MINIMAX PROCEDURES FOR THE USE OF INCOMPLETE PRIOR INFORMATION IN SELECTION AND CLASSIFICATION PROBLEMS
Ronald Herman Randles (Ph.D. Thesis) 1969 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-17679

A decision theoretic method of utilizing incomplete prior information is applied to three decision problems. If T is a class of prior distributions over the parameter space theta, a T-minimax decision rule is defined to be a rule beta which minimizes sup r(tau,beta) where r(tau,beta) denotes the expected risk. Dissert Abstr.

N70-31698# North Carolina State Univ., Raleigh. Applied Mathematics Research Group.
ON LINEAR INTEGRAL EQUATIONS FOR A CERTAIN CLASS OF H-FUNCTIONS APPLICABLE TO THE THEORY OF NEUTRON TRANSPORT AND RADIATIVE TRANSFER
E. E. Burniston and C. E. Siewert 16 Mar. 1970 18 p refs
(Grants AF-AFOSR-1779-69; NSF GK-11935)
(AD-703721; AFOSR-70-0814TR) Avail: CFSTI CSCL 12/1

A matrix version of the classical Riemann-Hilbert problem defined on an open contour is discussed. The problem is reduced to a quasi-regular integral equation for cases where the sufficient Holder continuity condition is satisfied and the component indices are non-negative. As an illustration of this procedure, linear integral equations, rather than the usual non-linear forms, for Chandrasekhars functions H sub I(u) and H sub r(u) are established in a form amenable to solution by numerical iteration. Author (TAB)

N70-31773# Watervliet Arsenal, N.Y.
AN INTERPOLATING CUBIC SPLINE FORTRAN SUBROUTINE
Raymond D. Scanlon Jan. 1970 35 p refs
(AD-702910; WVT-7010) Avail: CFSTI CSCL 12/1

A Fortran subroutine is presented which will construct a cubic spline interpolating an arbitrary set of points. The capability of handling various constraints on the first or second derivatives at the end points is included. Author (TAB)

N70-31782# Stanford Univ., Calif. Dept. of Computer Science.
COMPLEMENTARY SPANNING TREES
George B. Dantzig Mar. 1969 12 p refs
(Contracts DAHC04-67-C-0028; N00014-67-A-0112-0011; N00014-67-A-0112-0016; AT(04-3)-326; Grants NSF GP-6431; PHS-GM-14789)
(AD-702898; SU-CS-126) Avail: CFSTI CSCL 12/2

Given a network G whose arcs partition into non-overlapping clubs (sets) R sub i, D. Ray Fulkerson has considered the problem of constructing a spanning tree such that no two of its arcs belong to (represent) the same club and has stated necessary and sufficient conditions for such trees to exist. When each club R sub i consists of exactly two arcs, we shall refer to each of the arc pair as the complement of the other, and the representative tree as a complementary tree. Our objective is to prove the following theorem: If there exists one complementary tree, there exists at least two. Author (TAB)

N70-31795 Tulane Univ., New Orleans, La.
AN ANALYTIC SYSTEM FOR THE STATISTICAL ANALYSIS OF MARKOV CHAINS
Bruce Edward Rodda (Ph.D. Thesis) 1969 250 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-20498

The system consists of three types of programs: Those which estimate the parameters of the chain; classify the chain as absorbing, regular, or periodic; and provide for simulation of the process under consideration; those which describe the chain, i.e., generate the common descriptive statistics for each of the three chain classifications; and those which test hypotheses about independence, Markovity, and the agreement of the sample transition probability matrix with a specified matrix of transition probabilities. A study is analyzed using Markovian techniques. Subjects are blocked on age and past cardiac experience, and a finite Markov chain model is defined for each group. Differences between the groups are examined. The utilization of the multivariate analysis of variance for the analysis of finite Markov chains is introduced. Additional multivariate techniques which may be used in conjunction with a finite Markov chain model are presented. Dissert. Abstr.

N70-31800 Stevens Inst. of Tech., Hoboken, N.J.
A SPECTRAL DECOMPOSITION FOR CERTAIN OPERATORS IN A BANACH SPACE
William Robert Parzynski (Ph.D. Thesis) 1969 44 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-21301

Let T be a closed densely defined operator in a Banach space X. Assume the spectrum of T is contained in the real axis and the resolvent R(z,T) of T satisfies a given growth condition for some positive integer n, some positive real number K and all non-real z. From the above assumptions follows an approximation theorem. As a corollary each point in the point spectrum is characterized. Dissert. Abstr.

N70-31815 Washington Univ., Seattle.
CIRCUITS IN THE d-CUBE
Robert James Douglas (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-7042

Letting I to the d-th power be the 1-skeleton of the unit d-dimensional cube, define a (simple) circuit C in I to the d-th power to have spread k > or = to 1 if for all vertices x and y in C d(x,y) > or = to min(d sub c(x,y),k). A new upper bound is given for K(d,k) in the case of even k. Infinite classes of pairs (d,k) are given for which K(d,k) is determined exactly, one of the results proving an earlier conjecture. In addition, a new lower bound is given for the number of distinct Hamiltonian circuits in I to the d-th power, where a Hamiltonian circuit is a (simple) circuit in I to the d-th power passing through all the 2 to the d-th power vertices. Dissert. Abstr.

N70-31840 Dartmouth Coll., Hanover, N.H.
SOME APPLICATIONS OF GROUP THEORY TO ENUMERATIVE COMBINATORIAL ANALYSIS
Charles Peter Lawes (Ph.D. Thesis) 1969 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-18657

An expository presentation of certain group theoretic and combinatorial methods that have proved useful in the solution of enumeration problems in graph theory is discussed. The combinatorial theorems are presented as special cases of the following theorem. Let a group K act on a finite set Z, let X and Y be K-invariant subsets of Z (X and Y need not be disjoint) and let omega be a weight function from Y into a ring A of rational polynomials such that omega(sigma y) = omega(y). The action of K on Z induces an action of K on the set Y to the X power of

functions from X to Y defined sigma (f) = sigma f sigma to the minus one. Let w be a weight function for the set Y to the X power, and let f sub 1, f sub 2, ..., f sub q be an arbitrary set of representative functions, one from each of the orbits of K on Y to the X power. The combinatorial methods are shown to follow in a natural way from enumeration methods for one-to-one functions. Dissert. Abstr

N70-31885 Wisconsin Univ., Madison.
PRE-SELF-INJECTIVE RINGS AND PROJECTIVE MODULES OVER SEMI-PERFECT RINGS
Gary Brandt Klatt (Ph.D. Thesis) 1969 41 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-12385

Commutative rings (with identity) are studied all of whose proper homomorphic images are selfinjective rings. Such rings are called pre-self-injective. The first main result is that a commutative ring R is pre-self-injective if and only if it is one of the following: (1) A domain (necessarily Prufer) in which, for every maximal ideal M, R sub M is an almost maximal, rank 1 valuation domain; and in which each proper ideal is contained in only finitely many maximal ideals. (2) The direct sum of finite number of maximal, rank 0 valuation rings. (3) An almost maximal rank 0 valuation ring. (4) A local ring whose maximal ideal has composition length 2 and squares to 0. If R is noetherian, (1) becomes the class of Dedekind domains, while (2) and (3) become the class of principal ideal rings with DCC. The second main result is that a domain R with quotient field Q is pre-self-injective if and only if R has Krull dimension 1 and all R-homomorphic images of Q are R-injective. Dissert Abstr.

N70-31859*# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.
GRADIENT METHODS IN CONTROL THEORY. PART 4: SEQUENTIAL GRADIENT-RESTORATION ALGORITHM, FURTHER NUMERICAL EXAMPLES
J. N. Damoulakis 1970 40 p refs
(Grant NGR-44-006-089)
(NASA-CR-110524; AAR-67) Avail: CFSTI CSCL 12A

Meile and Pritchard developed the sequential gradient-restoration algorithm for minimizing a functional subject to certain differential constraints and boundary conditions. In this report, four examples are presented, two pertaining to the fixed-final-time case and two pertaining to the free-final-time case. The numerical results show the rapid convergence characteristics of the sequential gradient-restoration algorithm. Author

N70-31877# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Lab.
TRANSFORMATION OF A SET OF PSEUDO-RANDOM NUMBERS INTO A SET REPRESENTING ANY DESIRED PROBABILITY AND CORRELATION
Edward M. Holliday 12 Dec. 1969 160 p refs
(AD-704325; RE-TR-69-25) Avail: CFSTI CSCL 12/1

Many problems in engineering, economics, mathematics, and the sciences require investigations using digital simulations. Frequently the simulation of stochastic processes is required and is performed by a computer program which generates a pseudo-random sequence of numbers to represent random samples of the process. In general, it is not possible to control the probability and the correlation of the sequence at will. The objective of this report is the development of a general technique for digital generation of a set representing noise with independent control of the probability and t9 For this purpose, the set transformation method is developed and implemented in the computer subroutine identified as XFORM: A set of pseudo-random numbers is transformed into a second set which represents uncorrelated or correlated samples of any probability distribution. Existing methods of generating pseudo-random numbers representing uniform and nonuniform probability distributions, both uncorrelated and correlated, are reviewed. Two procedures for introducing correlation are developed. Two subroutines are developed to analyze random sets. TAB

N70-31894 Saskatchewan Univ., Saskatoon.
A COMPARISON OF DIRECT METHODS FOR ON-LINE PROCESS OPTIMIZATION
John Orville Edler (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-18650

A comparison is made of the effectiveness of a number of optimization techniques which are thought to be useful for on-line process optimization. Several types of optimization techniques are considered. These include two gradient techniques, two pattern techniques using a sequential simplex and the pattern search of Hooke and Jeeves respectively, three random search techniques, and a conditional probability computer as designed for process optimization. In addition to these optimization methods, variations of the random techniques, in which a non-zero mean is used for the random selections, are also considered. A method for weighting the mean of the random selections, based on the success or failure of past moves, is developed. The effectiveness of the optimization techniques is evaluated by testing their performance on response surfaces which are considered to be typical of those encountered in on-line process control. These response surfaces, which are simulated by mathematical equations, include multidimensionality, irregular response surfaces, process noise, and scaling errors. It is found that excellent performance may be expected from the random search techniques when a non-zero mean is used for the random selections which direct the search. The pattern search procedure of Hooke and Jeeves is also shown to be effective for on-line optimization, while the gradient techniques and the sequential simplex technique are somewhat less effective. An appendix, which summarizes a proof that the random search is effective in the presence of process noise, is included. Dissert. Abstr.

N70-31909 Michigan Univ., Ann Arbor.
NON-UNIMODULAR NETWORK PROGRAMMING
Kenneth Ralph Rebman (Ph.D. Thesis) 1969 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-18091

After briefly outlining various techniques for solving integer programming problems, several related network programming problems are formulated. Some of these (notably the assignment and transportation problems) are totally unimodular, and hence all extreme-point solutions are integral. The other problems formulated, although similar in structure, do not have this unimodular property. Thus, in determining the nature of extreme-point optima relative to integer-valued optima for one of these more general problems, one is led to consider the nature of determinants of non-singular submatrices of the constraint matrix. Two such non-unimodular network programming problems are considered in particular: the weighted matching problem and the two-commodity transportation problem. Dissert. Abstr.

N70-31910 City Univ. of New York.
A DECOMPOSITION THEOREM FOR A CLASS OF 2-COMPLEXES
Shaun Kevin O-Connell (Ph.D. Thesis) 1969 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-19064

The finite geometric complexes K sub 2 considered are composed of vertices, (open) rectilinear edges, and (open) planar faces which are the interiors of finite, convex planar polygons in R to the m power (m>1), where K sub 2 is nonsingular and connected, any pair of its faces having at most one closed edge or

one vertex in common. The theorem states that if K sub 2 is not a primitive irreducible, then it is reducible. If a complex is reducible, the process of decomposing is begun by extracting the stars of two edges of the same degree if they do not lie on the boundary of the same face, or by introducing a partitioning diagonal in the common face having at least four bounding edges, and extracting the appropriate sub-stars. We may iterate the above procedure, until K sub 2 is completely decomposed into two sets of pairwise homologous sub-stars of equal degree, a 1-dimensional skeleton, and possibly a primitive irreducible left over. Dissert. Abstr.

N70-31914# RAND Corp., Santa Monica, Calif. Dept. of Mathematics.
A NEW CHARACTERIZATION OF PARTIAL ORDERS OF DIMENSION TWO
Kirby A. Baker (California Univ., Los Angeles), Peter C. Fishburn (Res. Anal. Corp.), and Fred S. Roberts Mar. 1970 4 p refs Presented at Intern. Conf. on Combinatorial Math., 1-4 Apr. 1970 Submitted for publication
(AD-703862; P-4339) Avail: CFSTI CSCL 12/1

It follows from a theorem of Szpilrajn that any partial order (X, <) is the intersection of a collection of linear orders on X. Dushnik and Miller define the dimension D(<) of the partial order to be the cardinality of the smallest such collection of linear orders, and characterize the partial orders of dimension at most 2. In this note we combine this characterization with a theorem of Ghouila-Houri and Gilmore and Hoffman to obtain a new characterization of the partial orders of dimension at most 2. Author (TAB)

N70-31915 Clark Univ., Worcester, Mass.
STRUCTURES DETERMINED BY THE PRIME IDEALS OF RINGS OF CONTINUOUS FUNCTIONS
Richard Glee Montgomery (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-17714

Although the compact space Spec A, A being a commutative ring with unity, is generally not Hausdorff, each function f from a set S into Spec A has a continuous extension to beta S sub D, the Stone Cech compactification of S with its discrete topology. Moreover, certain aspects of this extension reveal the theoretical existence of a topology K sub A, whose underlying set coincides with that of Spec A, which is Hausdorff as well as compact and such that the forementioned extension is the Stone-extension of f: S sub D → K sub A. This dissertation results from efforts to realize the theoretically constructed space K sub A in a more familiar form and to investigate this space when A is a ring of continuous real-valued functions, emphasis being placed on the subspace consisting of the prime z-ideals. Following is a summary of our conclusions. Dissert. Abstr.

N70-31916 Rice Univ., Houston, Tex.
STABLE TANGENTIAL HOMOTOPY EQUIVALENCES
John Wilfard Morgan (Ph.D. Thesis) 1969 33 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-19321

Sullivan has given a characteristic variety theorem for classifying G/PL bundles in the category of PL manifolds. These bundles are classified by numbers assigned to certain singular submanifolds. In the category of simply connected PL manifolds of dimension at least 6 and non-empty boundary, the G/PL-bundle functor is naturally equivalent to the functor which assigns to M the concordance classes of homotopy triangulations of M. This set is denoted ht(M). In the category of closed, simply connected PL manifolds of dimension 5 or greater there is an exact sequence 0 → ht(M to the power of n) → [M to the power of n,G/PL] → P sub n → 0, P sub n. So, in either case, the elements of ht(M to the power of n) are classified by numbers associated to certain submanifolds of M to the power of n. Studied are thase elements in ht(M) which are represented by [L,f] where f:L to the power of n → M to the power of n is a stable tangential homotopy equivalence. Dissert. Abstr.

N70-31927*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SMOOTH EMPIRICAL BAYES ESTIMATION WITH APPLICATION TO THE WEIBULL DISTRIBUTION
G. Kemble Bennett (Ph.D. Thesis—Texas Tech. Univ.) Jun. 1970 222 p refs
(Grant NGR-44-011-029)
(NASA-TM-X-58048) Avail: CFSTI CSCL 12A

In most situations the parameters of a statistical distribution are not known with certainty and must be estimated. In this dissertation these parameters are treated as random variables and empirical Bayes point estimates are given. In particular, the two-parameter Weibull distribution is considered. Author

N70-31929 Colorado Univ., Boulder.
ON THE THEORY OF GENERALIZED COSSERAT SURFACES
James Watson Provan (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-19564

The isothermal infinitesimal bending theory of isotropic generalized Cosserat plates is derived by extending Green laws and Naghdi's Maclaurin series expansion theory of deformable bodies. Upon restricting the theory to initially flat surfaces, the theory uncouples into extensional and bending portions and a two dimensional matrix form of Stokes - Helmholtz decomposition theorem is applied to the bending theory. Four second-order partial differential equations in terms of four matrix stress functions are thereby obtained and all kinematic variables, stress resultants and higher order stress resultants are expressed in terms of these stress functions. This theory is applied in turn to the pure bending and torsion of a generalized Cosserat plate and comparisons of some of these results are made with their three dimensional elasticity theory counterparts in order to determine certain of the unknown material coefficients that are inherent in the generalized Cosserat theory. Dissert. Abstr.

N70-31937 Columbia Univ., New York.
ON FINITE GROUPS WHICH ARE DEFINED BY THEIR CHARACTERS
Chung-Mo Kwok (Ph.D. Thesis) 1968 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-17601

Let G be a finite group with a non-identity element x such that Chi(x) = Chi(1) or - Chi(1) + 2 for every irreducible character Chi of G. G is called a *-group. The following theorems are provided: (1) The order of x is either 2 or 4; (2) *-groups are solvable, and (3) G is a *-group if and only if G is the direct product of an arbitrary abelian finite group under given conditions. Dissert. Abstr.

N70-31938 Emory Univ., Atlanta, Ga.
SOME EMBEDDING THEOREMS FOR PARTIAL LATIN SQUARES
Charles Curtis Lindner (Ph.D. Thesis) 1969 44 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-19609

The basic definitions and ideas that are to be used in the paper are given. Some partial results are obtained on the conjecture that an n × n partial Latin square with n-1 cells occupied can be completed to an n × n Latin square. A proof of a theorem due to Trevor Evans that a finite partial Latin square can be embedded in a finite Latin square is also obtained. Some algebraic consequences

of these results are given. It is proved that a finite collection of mutually orthogonal finite partial Latin squares can be embedded in a complete set of mutually orthogonal infinite Latin Squares. Dissert. Abstr.

N70-31941*# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Material Science.
GRADIENT METHODS IN CONTROL THEORY. PART 6: COMBINED GRADIENT-RESTORATION ALGORITHM
A. Miele 1970 24 p refs
(Grant NGR-44-006-089)
(NASA-CR-110522; AAR-74) Avail: CFSTI CSCL 12A

The problem of minimizing a functional I which depends on the state x(t), the control u(t), and the parameter pi is considered. Here, I is a scalar, x an n-vector, u an m-vector, and pi a p-vector. At the initial point, the state x is prescribed. At the final point, the state x and the parameter pi are required to satisfy q scalar relations. Along the interval of integration, the state, the control, and the parameter are required to satisfy n scalar differential equations. A combined gradient-restoration algorithm is presented which is an iterative algorithm characterized by variations Delta x(t), Delta pi leading toward the minimal condition while simultaneously leading toward constraint satisfaction. These variations are computed by minimizing the first-order change of the functional subject to the linearized differential equations, the linearized boundary conditions, and a quadratic constraint on the variations of the control and the parameter. The resulting linear, two-point boundary-value problem is solved by the method of particular solutions. The descent properties of the algorithm are studied, and schemes to determine the optimum stepsize are discussed. Author

N70-31952 Ohio State Univ., Columbus.
DIRECTED METRIC SPACES
Thurston Woolever Shook (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-4970

Theorems are proved on hereditary subsets in directed metric spaces. Dissert. Abstr.

N70-31969# Columbia Univ., New York. Dept. of Mathematics.
ISOMORPHISMS BETWEEN TEICHMUELLER SPACES
Lipman Bers and Leon Greenberg [1969] 33 p refs
(Grant NSF GP-8735)
Avail: Issuing Activity

A theorem about isomosphisms between Teichmueller spaces is proved which was announced earlier without proof. References are provided for background information on Teichmueller space theory. The isomorphism theorem is related to a theorem on Fuchsian groups that can be stated in purely classical terms. The proofs of the two theorems are closely related. R.B.

N70-31977 John Hopkins Univ., Baltimore, Md.
PROPERTIES AND APPLICATIONS OF TEST STATISTICS INVARIANT UNDER ROTATION OF A CIRCLE
Edward David Rothman (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-21068

Suppose that a random sample of n observations is obtained from a random variable defined on the circumference of a unit circle. The problem of testing whether the sample is drawn from a uniform distribution or one of the following alternatives is discussed: H1 - The n observations are more regularly spaced than one would expect under the null hypothesis; H2 - The n observations are more clustered than one would expect under the null hypothesis; H3 - The n observations are drawn from an absolutely continuous, but unknown, distribution F(x). For each of these alternative, tests are obtained which are invariant with respect to the choice of origin. Testing a bivariante sample for independence of the components is discussed. The asymptotic distribution of D sub n under the null hypothesis of independence is shown to be a weighted infinite sum of chi-square random variables and the power of the test is obtained for a particular sequence of alternatives. Dissert. Abstr.

N70-31992 National Lending Library for Science and Technology, Boston Spa (England).
STATISTICAL METHODS, FREQUENCY DISTRIBUTION, MEAN VALUE AND DISPERSION: FUNDAMENTAL TERMS AND GENERAL METHODS
[1970] 23 p refs Transl. into ENGLISH from Foreign Report DIN-55302, Sheet 1, Jan. 1967
(NLL-RISLEY-Trans-1815-(9091.9F); DIN-55302) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Standard procedures are described for identifying the mean position and the dispersion of observed results, as used e.g. for the purpose of quality control and other statistical methods. Topics covered include: (1) frequency distribution of statistical quantities; (2) notation and classification of observed values; (3) frequency distribution and frequency sums; (4) construction of statistical characteristics (statistics); (5) arithmetic mean, standard deviation, and variance; (6) calculation from individual values and reduced individual values; (7) calculation from individual values of a series of observations; (8) approximate calculation from decades of individual values; and (9) calculation from classified values with the same class interval, including a method for the transformation of the class mid-points and a second method for the cumulative addition of the class frequencies. D.L.G.

N70-31993 California Univ., Berkeley.
RESULTS ON THE TRANSMISSION PROBLEM
Harold Robert Downs (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-3592

There are given two domains in Euclidean n-space with a portion of their boundaries in common. A boundary value problem is then posed for each domain with some of the boundary conditions for the portion in common involving the solutions of both problems. In each of the two domains a solution is found for the equation Au = f where A is a properly elliptic differential operator and u identifies a set of linear differential boundary conditions. An adjoint problem may then be defined. The main theorem states that this problem has a solution if f is orthogonal to every solution of the 'adjoint' problem. The proof given is a generalization of previous results in the case where the orders of the differential operators in each of the domains are different. Dissert. Abstr

N70-31994 Oregon State Univ., Corvallis.
A MATHEMATICAL MODEL SIMULATING MASS TRANSPORT OF CHEMICALS IN SATURATED POUROUS MEDIA
Frederick Thomas Lindstrom (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-18354

The development includes the physical phenomenon of adsorption of molecules of chemicals on the surrounding walls of the porous medium. Transport equations are developed for each system considered. Key physical parameters such as the total pore space, effective pore space, hydrodynamic flow velocity, diffusion coefficient, and retentive ability are included. Solutions to the transport equations are derived by the methods of integral transforms and finite differences. Experimental work on the first submodel is included. Theoretical curves for various values of the parameters for the remaining three submodels are given. Dissert. Abstr.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-30633# Allied Research Associates, Inc., Concord, Mass.
DOPPLER RADAR STUDIES OF STORM MOTION Final Report, 1 Jan. 1967 - 31 Dec. 1969
Raymond Wexler Feb. 1970 57 p refs
(Contract F19628-67-C-0117)
(AD-702827; ARA-9G42-F; AFCRL-70-0085) Avail: CFSTI CSCL 4/2

Analyses of Doppler radar measurements were made in different storms. In the storm of 26 Jun 1968, periods of heavy rain were associated with the passage of short-wave troughs at different levels in the atmosphere. There was a marked change in the wind field during a 15-minute period in the snowstorm of 7 February 1967. Discontinuities in the VAD pattern were interpreted as part of a sloping surface similar to a quasi-stationary front. The snowstrorm of 29 February-1 arch showed increasing strong NE winds at low levels increasing with time as the storm center approached. At upper levels above 5 km the reverse situation occurred: strong southerly winds decreasing markedly with time as the upper level low approached. In a thunderstorm on 7 Jun 1967, vertically pointing Doppler radar revealed the existence of a large tower extending above 12 km with upward velocities of 9 to 11 km, probably signifying updrafts of 10 to 15 m/sec. Deviation of storm motion from that of the environmental winds is due primarily to new cell growh on one side, dissipation on the other. The Magnus effect may play a role only during the later stages of the storm. Formulae for propagation rate and the motion of storm lines are derived, assuming constant line length and cell development along the line. Author (TAB)

N70-30651# Aerospace Corp., El Segundo, Calif. Lab. Operations.
HOT-WIRE ANEMOMETER INVESTIGATION OF SURFACE WIND VELOCITY AND TEMPERATURE FLUCTUATIONS AT TWO SOUTHERN CALIFORNIA SITES, AUGUST 1966 - MARCH 1968
David H. Ross 15 Mar. 1970 29 p refs
(Contract F04701-69-C-0066)
(AD-702795; TR-0066(9240-02)-1; SAMSO-TR-70-73) Avail: CFSTI CSCL 4/1

An experimental investigation of the atmospheric turbulence velocity and temperature fields was performed at The Aerospace Corp. San Fernando Observatory on Van Norman Lake and at The Aerospace Corp. parking lot, El Segundo, Calif. The velocity fluctuations were measured with a constant-temperature hot-wire anemometer and the temperature and optical index of refraction fluctuations with a laser turbulence meter. The instrument outputs were analyzed to provide overall rms value, power spectral density, and autocorrelation functions. Selected cases of the velocity data (where two probes were employed) were analyzed to yield cross-correlations and cross-spectra information. Measurements by both types of instrument at San Fernando indicated that turbulence was strongest near the ground and decreased up to 10 to 20 feet and then remained essentially constant up to 60 feet. This information was used in the design of the structure housing the new 24-in.-diam solar spectrohellograph to determine the optimum elevation of the instrument. Author (TAB)

N70-30677# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 228 13 May 1970 p 7-22 (See N70-30675 16-34)
Avail: CFSTI

Summaries are given of climate prediction, meteorological stations in the Antarctic, high-altitude cloud chamber, variations of solar constant, the change in drop size distribution in condensation chamber, the vertical component of refraction in Antarctica, conditions for observing halos in polydisperse clouds, condensation growth of droplets on hygroscopic nuclei, liquid water content of cumulus clouds, use of silver iodide in crystallizing supercooled fog, rainfall intensity and radar reflectivity, modification of clouds and fogs, meteorological radar, nonlinear orographic waves in the atmosphere, scattering of centimeter radiation by a layered hailstone, and macroprocesses in seasonal weather forecasts. R.B.

N70-30731*# Techtran Corp., Glen Burnie, Md.
SATELLITE METEOROLOGY, NO. 221
K. S. Shifrin, ed. et al Washington NASA Jun. 1970 273 p refs Transl. into ENGLISH of the publ. "Sputnikovaya Meteorologiya, Trudy 221" Leningrad, Hydrometeorol. Press, 1968
(Contract NASw-1695)
(NASA-TT-F-589) Avail: CFSTI CSCL 04B

Problems of interpreting satellite data and the methods of determining meteorological atmospheric parameters, according to the data of satellite measurements, are examined. Also presented are the results of investigation of radiation processes in the terrestrial surface atmosphere system. For individual titles, see N70-30732 through N70-30753.

N70-30735*# Techtran Corp., Glen Burnie, Md.
STATISTICAL CHARACTERISTICS OF THE SCANNING INFRARED EQUIPMENT SIGNALS
G. P. Vimberg et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 24-35 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Efforts were made to determine the effective indications of recognition of various radiating surfaces (cloudiness, underlying surface) according to the results of IR-equipment measurements of the experimental weather satellite Kosmos-122. Calculations of the following characteristics were carried out: one-dimensional laws of distribution of the amplitudes of the signal and their numerical characteristics, mathematical expectation, dispersion and central moments of the third and fourth orders; coefficients of correlation for all the second moment of distribution, asymmetry, and excess; autocorrelation functions of the amplitude of the signal along and across the direction of scanning of the IR-equipment. Author

N70-30736*# Techtran Corp., Glen Burnie, Md.
AUTOMATIC PROCESSING OF INFRARED INFORMATION COMING FROM WEATHER SATELLITES
V. F. Goverdovskiy et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 36-44 (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The algorithm and results of processing IR-information from meteorological satellites Kosmos-122 and Kosmos-144 by means of the VNIIEM-3 electronic computers are examined. In the field of radiation temperature the cloud systems are traced. The radiation temperature agrees with the temperature of the ground level layer of air in cloudless regions and reflects the thermal regime of the upper boundary of the clouds. The contrasts in the field of the radiation temperature reflect the boundaries and specific features of the underlying surfaces of various types, and make it possible to refine the analysis of cloud fields. Author

N70-30737*# Techtran Corp., Glen Burnie, Md.
EXPERIMENT IN COMPARING THE RESULTS OF MEASUREMENTS FROM THE GROUND, AIRCRAFT, AND SATELLITES
Ye. P. Barashkova et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 45-58 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Results of comparing shortwave and longwave radiation, and

temperatures of the underlying surface measured simultaneously on the ground network of actinometric stations are given. Measurements were obtained from an airplane and from a satellite above the European territory of the Soviet Union on 17 May, 1967. The relationship observed between the radiation characteristics at various levels, agree with the evaluations obtained according to the calculation systems. Author

N70-30738*# Techtran Corp., Glen Burnie, Md.
EXPERIMENT IN USING DATA ON OUTGOING SHORTWAVE RADIATION OBTAINED FROM KOSMOS 122 SATELLITE
K. S. Shifrin et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 59-76 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The short wave radiation balance of the atmosphere is presented. The calculations were performed on experimental data obtained with a narrow-sector receiver (NSR) aboard the Kosmos-122 satellite. The satellite data yield a noticeable anisotropy of the reflection from the water, the brightness increases with the mirror direction. This is the result of both the anisotropy of reflection, and the elongation of the atmospheric indicatrix of diffusion. The albedo, according to the NSR signal, agrees satisfactorily with the known values of the albedo of terrestrial covers, and the value of the radiation heating of the vertical column of the atmosphere coincides with the data of airplane measurements. Author

N70-30739*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF INTERPRETATION OF INFRARED PICTURES OF CLOUDINESS TAKEN FROM WEATHER SATELLITES
L. N. Guseva et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 77-105 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Problems connected with evaluating possible deviations of contrasts of radiation temperature of underlying surface, and cloudiness in each specific case from a corresponding most probable contrast are examined. An investigation of the influence on values of the contrasts of radiation temperatures by such factors as the degree of blackness of the underlying surface, the amount of cloudiness, the angle of sighting of the scanning equipment, and the spectral characteristics was carried out. The most probable corrections to the temperature of the underlying surface and the upper boundary of cloudiness, measured by the radiation method were obtained. Author

N70-30740*# Techtran Corp., Glen Burnie, Md.
PROCEDURE FOR CALCULATING THE SHORTWAVE RADIATION FIELD DURING ANISOTROPIC REFLECTION FROM THE UNDERLYING SURFACE
K. S. Shifrin *In its* Satellite Meteorology, No. 221 Jun. 1970 p 106-119 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

In evaluating the effect of anisotropic reflection on the field of diffused radiation, calculations taking into account only the double diffusion proved sufficient. The evaluations discovered the equality of the fields of diffused radiation above the arbitrary water surface and the Lambertian bottom with the direct radiation albedo. The contribution of the underlying surface to the diffused radiation decreases, if the role of multiple diffusion in the atmosphere increases (optical thickness grows). However, this contribution grows if we take into account not the single but the multiple diffusion with fixed parameters of the atmosphere. The radiation, absorbed by the layer of a turbid medium, is evaluated from above and from below by the values, obtained with an evaluation of only a single diffusion. Author

N70-30741*# Techtran Corp., Glen Burnie, Md.
PROBABILITY OF DETECTION OF CLOUDINESS AND UNDERLYING SURFACE BY THE IR-SYSTEM SIGNALS
G. P. Vimberg et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 120-128 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The possibilities of detecting cloudiness over various types of underlying surface, and also over various radiating surfaces against the background of the IR system's own noises are examined. It is shown that the IR system, installed on the Kosmos-122 satellite provided a sufficiently high probability of detection of cloudiness against the background of radiation of the principle types of underlying surfaces and the system's own noises. The probabilities of detection, calculated according to the experimental laws of distribution of the IR system video signal, are higher than the probabilities calculated from the condition of the normalcy of these laws. Author

N70-30742*# Techtran Corp., Glen Burnie, Md.
OUTGOING SHORTWAVE RADIATION FIELD ABOVE THE SEA
K. S. Shifrin et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 129-140 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

It is established that the surface of an agitated sea is much closer to the Lambertian than to the mirror surface. The reflection in the maximum of the solar glitter (with the wind velocity of 10 m/sec.) exceeds the isotropic reflection by only a few times, whereas the decrease of the reflection upon the passage from the quiet water to waves amounts to four orders. The outgoing shortwave radiation field (OSR) above an agitated sea, as indicated by the calculations, is relatively little different from the field above the isotropically reflecting water surface, and the excess of intensity in the solar glitter does not exceed 3.5 times for all the elevations of the sun. The contribution of the diffused radiation in the OSR field above the sea is substantial in any direction and it cannot be disregarded even in the maximum of the glitter, where it is no smaller than 30%. Author

N70-30743*# Techtran Corp., Glen Burnie, Md.
CONTRIBUTION OF DIFFUSED REFLECTION BY THE WATER LAYER TO THE OUTGOING SHORTWAVE RADIATION FIELD
V. Yu. Kolomiytsov *In its* Satellite Meteorology, No. 221 Jun. 1970 p 141-152 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

An approximate method is proposed for determining diffused radiation by the infinite thickness of water. It is based on the use of a great elongation of the diffusion indicatrix and complete internal reflection. It is calculated using the data on the albedo of the sea, and the radiation field in the atmosphere, caused by the diffusion in the water layer. The addition to the flows of outgoing shortwave radiation from this field amounts to 7 to 8%. Author

N70-30744*# Techtran Corp., Glen Burnie, Md.
RECONSTITUTION OF THE GROUND LEVEL PRESSURE FIELD ACCORDING TO THE WEATHER SATELLITE DATA
O. S. Bogomolov *In its* Satellite Meteorology, No. 221 Jun. 1970 p 153-158 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The possibilities of improving a method proposed for reconstitution of the pressure field according to data from meteorological satellites is examined. The enlistment, along with data on the amount of cloudiness, and information on the shape and height of the upper boundary, make it possible to improve appreciably the accuracy of the solution of the above-mentioned

problem. An evaluation is made of the possibility of reconstitution of the ground-level pressure field and the geostrophic wind on the basis of information on the cloudiness field. A good qualitative agreement of the calculated and actual pressure fields is noted. Above-mentioned procedure can be used for reconstitution of the pressure field and wind according to the satellite data above the regions, about which meteorological information is inadequate. Author

N70-30745*# Techtran Corp., Glen Burnie, Md.
ON THE DETERMINATION OF THE TEMPERATURE OF THE RADIATING SURFACE AND THE TOTAL MOISTURE CONTENT ACCORDING TO RADIATION MEASUREMENT ON A SATELLITE
B. D. Panin *In its* Satellite Meteorology, No. 221 Jun. 1970 p 159 - 171 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The problem of determinating the temperature of the radiating surface, taking into account the transformation of radiation by the atmosphere, and the total moisture content according to the measurements of the thermal radiation on modern weather satellites is analyzed. The solution of the problem is reduced to the solution of the system of two nonlinear algebraic equations with respect to the radiation energy at the temperature of the radiating surface and their special function corresponding to the total moisture content, according to the values of which then the temperature and moisture content are calculated. The results of the calculations, which are compared with the actual magnitudes of the values calculated, are given. Author

N70-30746*# Techtran Corp., Glen Burnie, Md.
EFFECT OF ANISTROPY OF THE REFLECTION FROM THE UNDERLYING SURFACE ON DETERMINATION OF THE FLOW OF OUTGOING SHORTWAVE RADIATION ACCORDING TO MEASUREMENTS FROM A SATELLITE
K. S. Shifrin et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 172 - 182 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The outgoing shortwave radiation (OSR) fields over snow and agitated seas is calculated. Formulas characterizing the increase in the sensitivity of the OSR field to the type of reflection indicatrix B with the growth of the albedo, are obtained. The OSR flows are practically independent of the type of B. A quantitative evaluation of the applicability of the Lambertian system of conversion from the brightness to the flow for the surface with arbitrary B and Albedo A is given. It shows that the greater is A the more rigid the requirements are presented to value B. With the exception of small regions of angles, the Lambertian system is applicable to the watery underlying surface and is not applicable to the snow surface Author

N70-30747*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF WIND VELOCITY AND WAVES ON THE SEA BY MEASURING THE SOLAR GLITTER PARAMETERS FROM SATELLITES
K. S. Shifrin et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 183 - 191 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

It is confirmed that it is possible to obtain not more than three gradations of wind velocity above the oceanic surface in the 0 to 15 m/sec. range. The measurement of wind direction and also velocities greater than 15 m/sec. is impossible by this method. It is necessary to have on the satellite a system, making it possible to measure the radiation, coming from the given point in two (or several) prescribed directions. A reliable method, with which it is possible to separate the cases of cloudless atmosphere in the measurements of the solar glitter from a satellite is developed. Aircraft measurements were made of the solar glitter at various wind velocities and sun elevations. Author

N70-30748*# Techtran Corp., Glen Burnie, Md.
ON THE PROBLEM OF AVERAGING IN MEASURING HYDROMETEOROLOGICAL FIELDS
N. N. Verenchikov *In its* Satellite Meteorology, No. 221 Jun. 1970 p 192 - 203 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Problems connected with averaging in the measurement of hydrometeorological fields is considered. An equation for determining the root-mean-square error with which the value of the hydrometeorological element averaged within the limits of a certain range, may be assumed equal to the true element at the moment of time sought is derived. Using the example of the temperature field of the surface in the Gulf Stream region it is shown how the representativity of the averaged measurements changes with the change in the averaging range. The variability of the averaged values of the hydrometeorological element, i.e., such characteristics for example as the radius of the representative measurements, the error in the interpolation of element according to its discrete averaged measurements, the required distance between the points of measurement with a prescribed maximum error of the measurement result interpolation, etc. is calculated. Author

N70-30749*# Techtran Corp., Glen Burnie, Md.
CERTAIN REGULARITIES IN THE VERTICAL DISTRIBUTION OF THE ASCENDING LONGWAVE RADIATION
Ye. P. Barashkova *In its* Satellite Meteorology, No. 221 Jun. 1970 p 204 - 224 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Analysis of the results of actinometric sounding brings us to the conclusion that the vertical distribution of the flow of ascending longwave radiation depends mainly on the distribution of the temperature. As the calculations have shown the moisture content has a substantial effect on the value of the ascending longwave radiation flow only upon the change within the limits in the ground layer of the atmosphere. In the general case the flow of ascending longwave radiation may be expressed through the soil temperature and the difference between the temperatures of the soil and air in the form of a formula. Author

N70-30750*# Techtran Corp., Glen Burnie, Md.
SPECTRAL BRIGHTNESS OF CLOUDS AND LANDSCAPE OBJECTS IN THE VISIBLE AND NEAR INFRARED SECTORS OF THE SPECTRUM
L. I. Chapursky et al *In its* Satellite Meteorology, No. 221 Jun. 1970 p 225 - 239 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Nadir measurements of the spectral brightness of five types of cloudiness and six types of underlying surface were made with elevations of the sun from 0 to 5 deg. The instrument was calibrated in absolute unital brightness. The equipment made it possible to control the stability of its characteristics in time. From the point of view of reflecting properties of natural formations the spectral variations of their brightness is explained. All the results of the measurements and calculations are represented in the form of graphs and tables. Author

N70-30751*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL INVESTIGATION OF LIGHT DIFFUSION BY CLOUD PARTICLES. 1: SIMULATION OF WATER

DROPLETS
O. I. Kasatkina *In its* Satellite Meteorology, No. 221 Jun. 1970 p 240–248 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

In investigating the light diffusion indicatrices by the cloud particles a method is proposed for simulating the water droplets. The models represent suspensions of glass globules in an immersion fluid. The optical characteristics of the models were examined in detail and compared with those of the water droplets. The methods for obtaining these models are examined and the possible degrees of polydisperseness of the suspensions obtained are evaluated. Author

N70-30752*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL INVESTIGATION OF DIFFUSION OF LIGHT BY CLOUD PARTICLES. 2: MEASUREMENT OF INDICATRICES OF DIFFUSION OF LIGHT BY WATER DROPLET MODELS
O. I. Kasatkina *In its* Satellite Meteorology, No. 221 Jun. 1970 p 249–257 refs (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

The indicatrices of light diffusion by models of cloud particles are measured in a wide range of angles of diffusion with high angle resolution. A description is made of the nephalometric apparatus making it possible to measure the indicatrices of light diffusion by the quasi-monodispersive suspension (the suspension of glass globules in a fluid) within a sufficiently small spread of particles with respect to size with high accuracy. The possible errors and the ways to decrease them are examined. Author

N70-30753*# Techtran Corp., Glen Burnie, Md.
CERTAIN CHARACTERISTICS OF THE STRUCTURE OF THE INTENSITY FIELD OF PRECIPITATION FALLING IN STEPPE AND DESERT REGIONS
Zh. D. Alibegova *In its* Satellite Meteorology, No. 221 Jun. 1970 p 258–261 (See N70-30731 16-20)
Avail: CFSTI CSCL 04B

Certain characteristics of the structure of the intensity field of liquid precipitation, falling on the territories of the Veliko-Anadol'skiy and Dubovskiy shower gauge groups and also of the Western Turkmenian and Western Kazakhstan discharge stations. The recurrences (%) of rains of various intensity and the shares of the precipitation of the given intensity in the total sum of the precipitation fallen are calculated. The recurrences of rains of various maximum intensities are given. Author

N70-30831# Physics Lab. RVO-TNO, The Hague (Netherlands).
TRANSMISSION OF THE ATMOSPHERE FOR VISIBLE LIGHT AT MEPPEN, GERMANY, OCTOBER 1967–OCTOBER 1968
A. J. B. C. Bal and J. D. P. van Dijk Mar. 1970 11 p refs
(PHL-1970-8; TDCK-55537-II) Avail: CFSTI

In Meppen, Germany, the transmission of the atmosphere for visible light was recorded on chart paper with an Eltro transmissometer. The measurements from October 1967 till October 1968 were converted on paper tape and worked out by a computer. The results show clearly a diurnal variation of the atmospheric transmittance for all seasons in agreement with the measurements of other inland meteorologic stations. In relation to night vision these measurements have to be considered as a supplement to the measurements of the nocturnal illumination and contrast decrease in the atmosphere, which are carried out at the same place and in the same year. Author

N70-30856*# Aztec School of Languages, Inc., Maynard, Mass.
EXPERIMENTAL STUDIES OF THE COUNTERRADIATION OF THE CLOUDED SKY
S. V. Ashcheulov et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 13–17 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The laws noted in the spectra for the counterradiation of the clouded sky are discussed. Two types of clouds were studied: nimbostratus and stratocumulus. The measured values for the intensities of counterradiation of the sky agreed well with the calculated ones for the nimbostratus, i.e., they almost did not differ from the radiation of an absolutely black body at the temperature of the lower boundary of the cloud, while those for the stratocumulus, in the atmospheric window of 8–12 micrometers, were found to be much lower than the calculated ones. Author

N70-30859*# Aztec School of Languages, Inc., Maynard, Mass.
SOME PROBLEMS IN TEMPERATURE SOUNDING OF THE ATMOSPHERE
K. Ya. Kondratyev et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 69–84 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04B

A brief review is given of the results obtained in studies of the problems of temperature sounding in the atmosphere, and the basic unsolved aspects of the problem are discussed. It is shown that, in selecting the spectral intervals, possible random deviations in the transmission functions must be considered. The effect of variability in the concentration of carbon dioxide and water vapor and the temperature on outgoing radiation is also evaluated. Author

N70-30863*# Aztec School of Languages, Inc., Maynard, Mass.
SOME RESULTS OF MEASUREMENTS OF THE SPECTRAL TRANSMISSION OF THE ATMOSPHERE UNDER THE CONDITIONS OF UPPER-LEVEL CLOUDS
L. V. Popova et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 145–152 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

Results are presented for determinations of the spectral nature of the transmission of cirrus clouds on the basis of ground measurements of the solar radiation passing through the upper-level clouds over Leningrad, Terskol Peak, and Mineral'nyye Vody. It is shown that the transmission of the upper-level clouds outside the absorption bands in the range of 0.4–0.8 and 4–13 micrometers is neutral on the average, and equal to 80–90%. Author

N70-30867*# Aztec School of Languages, Inc., Maynard, Mass.
EFFECT OF CLOUDS ON RADIATION FLUXES AND RADIATIVE HEAT TRANSFER IN THE FREE ATMOSPHERE
G. N. Gayevskaya *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 179–188 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The data obtained experimentally by different researchers for the amount of radiative heat transfer and the magnitude of radiative temperature changes in the free atmosphere when there are different types of clouds are reviewed. The data obtained by the actinometric soundings on airships under conditions of variable cloudiness, with solid clouds, are discussed in detail. Author

N70-30870*# Aztec School of Languages, Inc., Maynard, Mass.
ON THE VERTICAL AEROSOL DISTRIBUTION AND AEROSOL LAYERS IN THE ATMOSPHERE
A. M. Bunakova et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 207–215 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

Data obtained by different researchers for the vertical distribution of aerosols in the atmosphere by altitude are reviewed. It is shown that laser methods and spacecraft measurements have become very useful in these studies. Author

N70-30871*# Aztec School of Languages, Inc., Maynard, Mass.
THE EFFECT OF THE VERTICAL AEROSOL DISTRIBUTION ON THE RADIATION REGIME OF THE ATMOSPHERE
K. Ya. Kondratyev et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 216-223 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

Experimentally-determined profiles characterizing the extinction of direct solar radiation by the aerosol components of the atmosphere are discussed. The nature of the changes which the aerosol layers make in the vertical profile of the thermal radiation is examined. Author

N70-30873*# Aztec School of Languages, Inc., Maynard, Mass.
THE PROBLEM OF THE ROLE OF THE MECHANISMS FOR THE DISTRIBUTION AND SOURCES OF ATMOSPHERIC AEROSOLS
L. S. Ivlev *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 241-246 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

In order to construct an approximating schematic diagram of the aerosol distribution in the atmosphere, the atmosphere is divided into zones where different distribution mechanisms and sources are effective, and simplifying assumptions, such as the idea that there is no interaction between cosmic matter and the remaining aerosols, are made. Author

N70-30875*# Aztec School of Languages, Inc., Maynard, Mass.
THE EFFECT OF SOME SUBSTANCES ON THE COEFFICIENT OF CONDENSATION OF WATER DROPS
B. M. Shinyayev *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 256-260 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The coefficient of condensation of water drops is examined in relation to three substances: sodium alurate, sodium palminate and isoamyl alcohol. It is assumed that the nature of the effect of molecules of soluble surface-active solutions on the evaporation differs basically from the characteristics of surface films of non-soluble SAS's. Author

N70-30876*# Aztec School of Languages, Inc., Maynard, Mass.
THE POSSIBILITY OF INTERPRETING THE DATA OF A SEDIMENTATION ANALYSIS
M. M. Kokhanovich et al *In its* Probl. of Atmospheric Phys. Collection 5 Jun. 1970 p 261-264 refs (See N70-30852 16-13)
Avail: CFSTI CSCL 04A

The results are presented for a parallel study of the distribution of drops by size of a modeled nebula obtained by a sedimentation analysis and by the microphotographic method in order to illustrate the advantages of the former method. It is shown that the sedimentation method of analyzing the degree of dispersion of a modeled nebula gives a completely clear and precise representation of the distribution of the drops in it by size. Author

N70-31048# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF TRANSPARENCY OF FOGS PRODUCED IN EXPERIMENTAL EQUIPMENT
O. A. Volkovitskii et al 6 Jan. 1970 14 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (Leningrad), no. 7, 1967 p 21-27
(AD-702962; FTD-MT-24-418-69) Avail: CFSTI CSCL 4/2

A description is given of equipment used to measure transparency of fogs in experimental installations. Measuring errors of transparency and determination of the meteorological visual range in fogs are given. Author (TAB)

N70-31161*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE POTENTIAL TEMPERATURE PROFILE IN THE PLANETARY BOUNDARY LAYER
George H. Fichtl and Julian F. Nelson 27 Apr. 1970 41 p refs
(NASA-TM-X-64519) Avail: CFSTI CSCL 04B

Nineteen observations of the temperature profile are used to analyze and develop a model of the potential temperature profile in the planetary boundary layer. The observations consist of mean flow temperatures observed at the 3, 18, 30, 60, 120, and 150 meter levels at the NASA 150-meter meteorological tower site. It is pruvisionally concluded that the dimensionless potential temperature gradient is a function of height above natural grade and surface Monin - Obukhov length. The function of dimensionless potential temperature gradient is integrated to yield the potential temperature profile and estimates of the potential temperature drop across the planetary boundary layer. Author

N70-31278# Weather Bureau, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES, NATIONAL METEOROLOGICAL CENTER, FIRST HALF OF 1969
Jan. 1970 46 p refs
Avail: CFSTI

The activities of the meteorological center are reported. Included areas are: data automation, extended forecast, forecast verification, and facsimile transmissions. F.O.S.

N70-31286# Weather Bureau, Silver Spring, Md. Weather Analysis and Prediction Div
WEATHER BUREAU FORECAST VERIFICATION SCORES 1968 1969 AND SOME PERFORMANCE TRENDS FROM 1966
Robert G. Derouin and Geraldine F. Cobb May 1970 50 p refs
(ESSA-TM-WBTM-FCST-15) Avail: CFSTI

Performance scores of the FP/NMC and local programs are compared. During 1968 - 69, based on resolution and reliability components of the Brier Score, it appeared showers were best handled the first period by FP centers, beyond this time by the local offices and during winter at least, NMC had the better understanding of the atmospheric dynamics. During the summer of 1968, newly established WBFOs did slightly better than older WBFOs in forecasting temperatures and about the same for precipitation. Since 1966, scores showed precipitation easier to forecast in the winter and temperatures in the summer, with each echelon showing a small but steady improvement yearly and over succeeding echelons. Author

N70-31302# Meteorology Research, Inc., Altadena, Calif.
WARM FOG MODIFICATION. Final Report, 14 Aug. 1968 - 31 Jan. 1970
Theodore B. Smith, Chen-Wu Chien, and Alan I. Weinstein 30 Jan. 1970 54 p refs
(Contract F19628-69-C-0021)
(AD-704142; MRI-70-FR-903; AFCRL-70-0105) Avail: CFSTI CSCL 4/2

A program was initiated to investigate the treatment of warm fogs by hygroscopic materials. The philosophy of the program has been to conduct interactive field experiments and modeling studies aimed ultimately at the development of a computational technique which could explore hygroscopic treatment effects with a variety of material, environment, source parameters. Field programs were carried out at Santa Rosa and Columbia, California, using three, side-by-side, C-47 aircraft to dispense sized materials. A sampling aircraft then flew across the three wakes to record the treatment effects through observations of backscatter, liquid water content, and droplet concentrations. A model of hygroscopic treatment was evolved which simulated aircraft release of the material into a

wake region of 40 × 35 m. Growth by condensation, evaporation, sedimentation of particles and diffusion of material, natural cloud drops, and vapor were all included in the model. The model was used to explore several possible treatments, but a field validation of the model is required before carrying out extensive calculations. A brief, field program was carried out during the spring of 1969 at Lakeport, California, using only one C-47 as the treatment aircraft. The primary purpose of the program was to explore the use of larger quantities of material. Best effects were obtained with two to three successive releases in the same area. Author

N70-31356# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 7: STATISTICAL PROFILES AND SINGLE ASCENTS [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 7: STATISTISCHE PROFILE UND EINZELAUFSTIEGE]
W. Alfuth Nov. 1969 42 p In German
(GeophysBDBw-FM-147) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli (Libya) from 1951 to 1957, are discussed. The monthly statistical profiles of atmospheric pressure, temperature, and density, together with those from three single ascents each month, are given. ESRO

N70-31421# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
A WIND-WEIGHTING TECHNIQUE TO PREDICT VELOCITY VECTOR AZIMUTH ANGLES FOR UNGUIDED ROCKETS
Gordon L. Dunaway Dec. 1969 31 p refs
(AD-700955; ECOM-5286) Avail: CFSTI CSCL 4/2

A method is presented for the prediction of velocity vector azimuth angles of unguided rockets versus altitude or time using the wind-weighting technique. The method was evaluated using a trajectory simulation program in a high-speed computer, and the evaluation showed that useful predictions could be made. Moreover, the technique can be applied rapidly and, therefore, is well suited for operational use. Author (TAB)

N70-31475# Environmental Technical Applications Center (Air Force), Washington, D.C.
WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 7, PART 7: UNITED STATES OF AMERICA APPALACHIAN MOUNTAINS, MIDDLE ATLANTIC REGION AND NORTHEAST REGION
Mar. 1970 538 p
(AD-703606) Avail: CFSTI CSCL 4/2

The volume provides climatological summaries for airfields and climatic areas in the United States. Summaries are arranged according to numbered climatic areas, and by increasing WMO Station Index Numbers within the climatic areas. Maps are included to delineate areas and station locations. Climatic areas have been selected as being nearly homogeneous climatologically, but considerable variation may exist between locations in an area at a specific time because of topography and other factors. Climatological summaries for these areas follow those for the included airfields. Author (TAB)

N70-31476# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 3: FREQUENCY DISTRIBUTIONS [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 3: HAEUFIGKEITSVERTEILUNGEN]
W. Alfuth Dec. 1968 55 p In GERMAN
(GeophysBDBw-FM-I/140) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli, Libya, from 1951 to 1957 are discussed. Tables of the frequency distributions of atmospheric pressure, temperature, and density are given. ESRO

N70-31477# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 4: CORRELATION MATRICES [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 4: KORRELATIONSMATRIZEN]
W. Alfuth Dec. 1968 17 p In GERMAN
(GeophysBDBw-FM-I/141) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli, Libya, from 1951 to 1957, are discussed. Correlation matrices of atmospheric pressure, temperature, and density are given. ESRO

N70-31478# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 5: CHARACTERISTIC VALUE OF GIVEN CUMULATIVE FREQUENCIES [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 5: MERKMALSWERT ZU VORGEGEBENEN SUMMENHAEUFIGKEITEN]
W. Alfuth Oct. 1969 72 p ref In GERMAN
(GeophysBDBw-FM-145) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli (Libya) from 1951 to 1957, are discussed. The values of the atmospheric temperature, pressure, and density, which correspond to given cumulated frequencies, are listed. ESRO

N70-31479# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 1: WORK REPORT [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 1: ARBEITSBERICHT]
W. Alfuth Nov. 1968 51 p refs In GERMAN
(GeophysBDBw-FM-I/138) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli, Libya, from 1951 to 1957 are discussed. The data were statistically analysed with computers and a general outline of the project is given. ESRO

N70-31480# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 2: STATISTICAL PARAMETERS [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 2: STATISTISCHE PARAMETER]
W. Alfuth Nov. 1968 57 p refs In GERMAN
(GeophysBDBw-FM-I/139) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli, Libya, from 1951 to 1957, are discussed. The data were processed statistically in several ways by means of two digital computers. Tables of statistical parameters for atmospheric pressure, temperature, and density are given. ESRO

N70-31481# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 6: EXTREMES [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS/LIBYEN, 1951–1957. TEIL 6: EXTREME]

W. Alfuth Oct. 1969 40 p In GERMAN
(GeophysBDBw-FM-146) Avail: CFSTI

Radiosonde ascents above 20 km from Tripoli (Libya) from 1951 to 1957, are discussed. The monthly extremes of atmospheric pressure, temperature, and density at km-steps, are presented. ESRO

N70-31530# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

WIND TUNNEL STUDIES OF THE AIR FLOW AND GASEOUS PLUME DIFFUSION IN THE LEADING EDGE AND DOWNSTREAM REGIONS OF A MODEL FOREST

R. N. Meroney and B. T. Yang Fort Huachuca, Ariz. ECOM Nov. 1969 72 p refs
(Contract DAAB07-68-C-0423)
(AD-703892; CER69-70RNM-BTY-17; ECOM-C-0423-6) Avail: CFSTI CSCL 4/2

A model forest canopy was designed to simulate the meteorological characteristics of typical live forests. Measurements were made of velocity, turbulence, drag, and gaseous plume behavior. Flow properties are compared with recent field measurements. Ground penetration in the initial fetch region results in strikingly different streamline motion as compared to wind motions within the equilibrium regions. Measured values of the vertical eddy diffusion coefficient are shown to predict plume behavior in the equilibrium region very well if a correction is included for the ratio $Ky/Kz > 1.0$. Ventilation of an elevated line source into the canopy region is compared with a simple one-dimensional model. Author (TAB)

N70-31531# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

STRATIFIED FLOW OVER AN OBSTACLE: A NUMERICAL EXPERIMENT

Jung-Tai Lin and C. J. Apelt Jan. 1970 87 p refs
(Contract N00014-68-A-0493-0001)
(AD-703673; CER69-70JTL-CJA25; THEMIS-CER-TR-7) Avail: CFSTI CSCL 4/1

Numerical studies of time-dependent, two-dimensional, stratified flow of incompressible, viscous, diffusive fluid are described. The particular physical problem which was considered is that of stratified flow over a vertical fence when the motion is impulsively started from rest. A new iterative method was used for numerical integration of the governing equations and was found to be very effective. The method is based on the combination of the Crank-Nicolson method with a strongly implicit iterative method developed by Stone (1968). Full details of the method are given together with a summary of its performance on the problems calculated. It is shown that proper treatment of the inflow and outflow boundary conditions is crucial for successful numerical modeling of stratified flows. Author (TAB)

N70-31585# Syracuse Univ. Research Corp., N.Y.

RADIO REFRACTIVITY AND METEOROLOGICAL DATA PLOTS FROM RADIOSONDE LAUNCHES: TRADE WINDS, MARCH 1969

L. G. Rowlandson and J. S. Schwarz Bedford, Mass. ESD Jan. 1970 241 p refs
(Contract F19628-68-C-0208)
(AD-702929; ESD-TR-70-60) Avail: CFSTI CSCL 4/2

Radiosonde data were collected from the Northern part of the Caribbean Sea, during the period 6 March through 26 March 1969. Stations were selected to encompass the area wherein instrumented aircraft measurements were made of meteorological and radio refractivity parameters. Author (TAB)

N70-31741# Weather Wing (6th), Detachment 30, Vandenberg AFB, Calif.

FORECASTING STRATUS/FOG DAYTIME BREAKING AT VANDENBERG AIR FORCE BASE

Mar. 1969 11 p
(AD-702908) Avail: CFSTI CSCL 4/2

An objective method of forecasting dissipation or non-dissipation of stratus at Vandenberg AFB was developed using the height and strength of the marine inversion as predictors. The method correctly identifies dissipation cases, however, much subjectivity must be used to identify non-dissipation cases. Author (TAB)

N70-31744*# National Weather Records Center, Asheville, N.C.

AN EMPIRICAL ANALYSIS OF THE 10–15 km MAXIMUM WINDS TO DETERMINE APOLLO AND AAP LAUNCH OPPORTUNITIES, CAPE KENNEDY, FLORIDA

Harold L. Crutcher and Nathaniel B. Guttman Huntsville, Ala. NASA, Marshall Space Flight Center Jan. 1969 557 p refs
(NASA Order H-76789)
(NASA-CR-61260) Avail: CFSTI HC $10.00/MF $0.65 CSCL 04B

The first of this two-part study gives the launch opportunity empirical probabilities at Cape Kennedy, Florida. A launch opportunity is defined as an opportunity to launch a vehicle through the wind field of the 10–15 km region when certain specified prior conditions have been given for launching. Wind observations are available at 12-hour intervals. There may be one launch opportunity in each 12-hour period. The probabilities are presented for the number of opportunities for monthly reference periods. The periods range from one 12-hour interval to forty 12-hour intervals or twenty days. The probabilities are presented for both consecutive and nonconsecutive opportunities. The second part presents the empirical probabilities for no opportunity to launch a vehicle. Again, the consecutive and nonconsecutive features are given for each month. The empirical probabilities are based on records available for the overall period from January 1956 through December 1963 for the Cape Kennedy area. Author

N70-31794# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

ATMOSPHERIC OZONE INVESTIGATIONS AT BARROW, ALASKA, DURING 1966, 1967

John J. Kelley Jan. 1970 137 p refs
(Contract N00014-67-A-0103-0007)
(AD-702747; SR-5) Avail: CFSTI CSCL 4/1

The results of the measurements of ozone in the air at Barrow, Adak, Wales, and Fairbanks, Alaska, are presented. The average daily and hourly concentrations of ozone in the atmosphere near the ground surface are tabulated for the years 1966 and 1967. The results of the analysis of ozone measured continuously from light aircraft along several transects in northern Alaska are given. Author (TAB)

N70-31821# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

APPLICATION OF A NEW MEASURING PRINCIPLE TO DETERMINE THE DIRECTION OF HIGHLY ENERGETIC NEUTRONS IN THE LOWER ATMOSPHERE [ANWENDUNG EINES NEUEN MESSPRINZIPS ZUR RICHTUNGSBESTIMMUNG HOCHENERGETISCHER NEUTRONENIN DER UNTEREN ATMOSPHAERE]

Volker Schoenfelder (Ph.D. Thesis) 14 Jan. 1970 122 p refs In GERMAN
Avail: CFSTI

Coincidence-anticoincidence meters carried on balloons were use to determine the angular distribution of atmospheric neutrons on ground level and at heights of 770 g/sq cm. Compared were the kinematics of double elastic scattering processes on hydrogen nuclei to obtain the zenith angle distribution. Neutron trajectories were photographic recorded. Results show that incidence with a primary elastic n-p impact can be readily differentiated from inelastic n-C impacts. Transl. by G.G.

N70-31875# ARO, Inc., Arnold Air Force Station, Tenn.
SPHERE DRAG IN THE FREE-MOLECULAR AND TRANSITIONAL FLOW REGIMES Final Report, 14 Apr. - 26 Sep. 1969
David L. Whitfield and William B. Stephenson AEDC Apr. 1970 46 p refs Submitted for publication
(Contract F40600-69-C-0001)
(AD-704122; AEDC-TR-70-32) Avail: CFSTI CSCL 4/2

Results are presented of sphere drag measurements made in the free-molecular and transitional flow regimes. The drag data were obtained using a drag balance and the free-flight technique. Conditions for which measurements were made are given. An analysis of the drag on a sphere in rarefied flow is also presented, and the results are compared with experimental data and other theories. The analytical results well predict the trend of the experimental data in the transition regime and remain valid at Knudsen numbers for which previous theories are not applicable. Author (TAB)

N70-31887# Roberts (James A.) Associates, Inc., Tustin, Calif.
A COASTAL MESOCLIMATOLOGY OF THE POINT CONCEPTION TO MORRO BAY REGION OF CALIFORNIA Final Report, 28 Jun. 1968 - 13 Jan. 1970
James A. Roberts, Kenneth M. Beesmer, Ernest L. Seeman, and Michael F. Harris 9 Jan. 1970 92 p
(Contract DAHC-04-68-C-0036)
(AD-703934; JARA-1101; AROD-7956-1-EN) Avail: CFSTI CSCL 4/2

Meteorological data were collected over an 18 month period for the coastal region from Morro Bay to Point Conception in California. These data, along with data from the Weather Bureau and other sources, have been utilized in defining the climatic patterns of the study area and attempting to explain the variations observed. Although the detailed data covers a limited period of time, seasonal and diurnal variations have been observed. Climatic modification by a headland was observed during periods when a low level inversion existed and the wind flow was onshore from the cold ocean. Surface observations of wind and temperature and aircraft observations of the temperature variations indicate that colder air can be expected in the convergent zone upwind of the headland with warmer air, probably a result of subsidence, in the area of divergence downwind. Author (TAB)

N70-31899 Johns Hopkins Univ., Baltimore, Md.
MEASUREMENTS OF NIGHTTIME O2 DENSITIES IN THE UPPER ATMOSPHERE FROM FAR-ULTRAVIOLET ABSORPTION
Chet Brian Opal (Ph.D. Thesis) 1969 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-21075

Nighttime oxygen densities in the 120 km region over White Sands, New Mexico, and Churchill, Manitoba, were determined with the use of rocket-borne instruments which measured the attenuation of far-ultraviolet radiation by the Schumann - Runge absorption continuum. The far-ultraviolet intensities of a hot star and of auroral emissions were also measured. The measurements indicate that winter O2 densities at 120 km at high latitudes are at least a factor of 2 higher than those in temperate regions. It is difficult to explain this result by reduced dissociation or a higher turbopause level alone. The high O2 density observed was probably due to a greater total atmospheric density produced by increased temperatures in the 90 to 120 km region. Several mechanisms peculiar to the winter arctic atmosphere could produce the required heating, but O2 density measurements alone do not indicate which is the most important. Dissert. Abstr.

N70-31903# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Dept.
A STUDY OF THE MAGNITUDE OF THE SEASONAL, CLIMATIC AND DAY-NIGHT VARIATION IN THE TROPOSPHERE
B. Boykin and G. W. Tacke Mar. 1970 49 p
(AD-704093; NWL-TR-2260) Avail: CFSTI CSCL 4/1

This report consists of a study of seasonal, climatic, and day-night variations in calculated tropospheric refractivity at three selected stations over a six year period, with a comparison of the relative magnitude of the three variations. The total refractivity N is approximately a negative exponential with altitude and this function has been fitted to the calculated data. It was found that while the seasonal, and climatic variation produced a larger variation in the refractivity, the day-night variation was relatively small. A detailed description, including flow diagrams and Fortran IV coding, is given for the program used in this study to reduce and evaluate the data. Author (TAB)

N70-31936*# National Weather Records Center, Asheville, N.C.
PREDICTION OF THE MAXIMUM WIND SPEED IN THE 10 - 15 km LAYER ABOVE CAPE KENNEDY
H. L. Crutcher, J. A. Almazan, and Frank T. Quinlan Huntsville, Ala. NASA. Marshall Space Flight Center Jan. 1969 300 p
(NASA Order H-76789)
(NASA-CR-61257) Avail: CFSTI CSCL 04B

Tables are presented for the prediction of the maximum wind speed in the 10 - 15 km layer above Cape Kennedy, Florida. These tables contain conditional probabilities based on eight years of data. The tables are presented by month. These permit the selection of probabilities that the maximum wind speed will be above (or below) a selected criterion for a specified period of time provided that the maximum speeds have been above (or below) the same speed criterion or certain periods of time. Author

N70-31953*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROBABILITY DISTRIBUTIONS FOR THUNDERSTORM ACTIVITY AT CAPE KENNEDY, FLORIDA
Lee W. Falls, William O. Williford, and Michael C. Carter 12 May 1970 23 p refs
(NASA-TM-X-53867) Avail: CFSTI CSCL 04B

Several statistical distribution functions are investigated as prospective models to represent the variation of thunderstorm activity at Cape Kennedy, Florida. Statistical methods are presented using the latest and most comprehensive thunderstorm data available. The conclusion is reached that the negative binomial distribution and a modification of the negative binomial distribution are adequate statistical models to represent thunderstorm events and thunderstorm hits, respectively, at Cape Kennedy, Florida. Author

N70-31984*# Allied Research Associates, Inc., Concord, Mass.
NASA/ESSA WEFAX EXPERIMENT, ATS-1 Evaluation Report
Arthur R. Hall and Lawrence Berry [1970] 213 p
(Contract NAS5-10204)
(NASA-CR-110529; TR-3) Avail: CFSTI CSCL 04B

The Weather Facsimile (WEFAX) experiment was conducted to determine by actual demonstration, the feasibility of disseminating meteorological data and satellite cloud camera pictures from a central weather station source to widely scattered remote weather stations or receiving units. Evalustions of the WEFAX transmissions during January through December 1967 are discussed and documented in separate monthly sections. The actions taken by the experimenters during December 1966 to prepare and test the WEFAX transmission system in both normal and emergency modes are briefly discussed. The major problems encountered during the experiment, and the experiment conclusions are also presented.
Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-30833# Advisory Group for Aerospace Research and Development, Paris (France).
HUMAN FACTORS IN THE GROUND CONTROL OF AIRCRAFT
N. David Hopkins (Roy. Air Force, Farnborough, Engl.) Apr. 1970 184 p refs
(AGARDograph-142; AGARD-AG-142-70) Avail: CFSTI

CONTENTS:

1. INTRODUCTION p 1-5
2. SURVEY OF PROBLEMS AND TOPICS p 6-15 (See N70-30834 16-05)
3. STAGES OF HUMAN FACTORS CONTRIBUTIONS p 16-27 (See N70-30835 16-05)
4. AIR TRAFFIC CONTROL SYSTEMS p 28-33 (See N70-30836 16-21)
5. AIR DEFENCE SYSTEMS p 34-38 (See N70-30837 16-21)
6. THE ANALYSIS OF SYSTEMS AND JOBS p 39-49 (See N70-30838 16-05)
7. DESIGN AND ASSESSMENT OF DISPLAYS AND CONTROLS p 50-62 (See N70-30839 16-05)
8. COMMUNICATION p 63-69 (See N70-30840 16-07)
9. MAN IN THE MAN-MACHINE SYSTEM p 70-78 (See N70-30841 16-05)
10. INDIVIDUAL DIFFERENCES p 79-87 (See N70-30842 16-05)
11. THE ROLE OF SIMULATION p 88-91 (See N70-30843 16-05)
12. MEASUREMENT OF PERFORMANCE p 92-100 (See N70-30844 16-05)
13. IDENTIFICATION OF FACTORS RELEVANT TO TASK PERFORMANCE p 101-107 (See N70-30845 16-05)
14. RELEVANCE OF OTHER RESEARCH FINDINGS p 109-113 (See N70-20846 16-05)

N70-30836# Advisory Group for Aerospace Research and Development, Paris (France).
AIR TRAFFIC CONTROL SYSTEMS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 28-33 (See N70-30833 16-21)
Avail: CFSTI

Airspace is divided into upper, middle, and lower regions with different air traffic control procedures in each. Many of the human factors problems in air traffic control are affected by the quality of the data available and by characteristics of various navigation aids. Civil and military air traffic control systems are not at the same stage of integration in all parts of the World. Factors affecting control at airports, in terminal areas, in sectors and over oceans are indiciated briefly, and, for each type of control, certain current problems are mentioned, together with their human factors implications.
Author

N70-30837# Advisory Group for Aerospace Research and Development, Paris (France).
AIR DEFENCE SYSTEMS
In its Human Factors in the Ground Control of Aircraft Apr. 1970 p 34-38 (See N70-30833 16-21) Avail: CFSTI

The development of modern air defence systems from those which evolved during the Second World War is described. Most of the original human factors problems remain in current systems, but increased complexity and automation have introduced further problems. Much of the human factors work in these systems has been concerned with the presentation and interpretation of information on radar and with environmental and other factors affecting their use. Tracking has also been a recurring research topic. More recently, problems in decision-making, communications, and work by teams of operators have been tackled, though many outstanding questions have still to be resolved. Pressures to amalgamate air defence and air traffic control systems also contribute to human factors problems.
Author

N70-30851*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF THE FINE-POINTING CONTROL SYSTEM OF A SOFT-GIMBALED ORBITING TELESCOPE
Frederick R. Morrell Washington Jun. 1970 38 p refs
(NASA-TN-D-5829; L-6988) Avail: CFSTI CSCL 17G

Computer simulation results are presented for the rigid-body planar equations of motion of an attitude-stabilized orbiting telescope passively coupled to a manned service module. This coupling is provided through a set of soft springs and a two-axis gimbal alined with the telescope center of mass. Principal nonlinearities in the suspension system and the telescope control system are included. The simulation indicates feasibility of this operational mode.
Author

N70-30932# Department of Transportation, Washington, D.C.
AIR TRAFFIC CONTROLLER CAREER COMMITTEE REPORT Final Report
John J. Corson Jan. 1970 165 p refs
(AD-700925) Avail: CFSTI CSCL 5/9

The report presents recommendations as to what needs be done with respect to manning the air traffic system, improving working conditions, bettering the controllers career, and improving employee-management relations. The recommendations are neither novel nor unexpected. There is an especial need for expeditious consideration of those recommendations designed to resolve the employee-management relations problems which threaten the system.
Author (TAB)

N70-31001*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
COMMERCIAL AIR TRANSPORT HAZARD WARNING AND AVOIDANCE SYSTEM. VOLUME 1: SUMMARY Final Report
G. W. Casserly and D. W. Richardson May 1970 29 p
(Contract NAS12-2108)
(NASA-CR-86392; PNSI-TR-70-0414-I) Avail: CFSTI CSCL 17G

Analysis of the operational requirements for a commercial air transport hazard warning and avoidance system was performed in conjunction with a study of the available sensor technology suited to such a system. Particular emphasis was placed on the

problem of low visibility landings through a comprehensive investigation into such factors as meteorological and visibility data, aircraft accident statistics, airline-related economic benefits, current and future landing aids, and present operating procedures. The technology study was concentrated primarily in the area of microwave sensors at frequencies in the X, Ka, Ku, and V bands, with some additional analysis of electro-optical and infrared sensors. Operational requirements were studied for landings in visibility conditions down to and including Category 3C. Author

N70-31002*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
COMMERCIAL AIR TRANSPORT HAZARD WARNING AND AVOIDANCE SYSTEM. VOLUME 2: REQUIREMENTS STUDIES Final Report
E. Bolz, G. W. Casserly, W. Polhemus, D. Richardson, T. G. Thorne et al L. Ursel May 1970 218 p refs
(Contract NAS12-2108)
(NASA-CR-86393; PNSI-TR-70-0414-II) Avail: CFSTI CSCL 17G

CONTENTS:

1. HAZARDS TO AIRCRAFT DURING APPROACH AND LANDING p 5–18 (See N70-31003 16-02)
2. ECONOMIC BENEFIT OF IMPROVED LANDING CAPABILITY p 19–30 (See N70-31004 16-02)
3. DESIRED CHARACTERISTICS HAZARD WARNING AND AVOIDANCE SYSTEM p 31–59 (See N70-31005 16-21)
4. APPROACH AND LANDING AIDS p 60–80 (See N70-31006 16-21)
5. SENSOR PERFORMANCE p 81–158 (See N70-31007 16-21)
6. SYSTEM CONFIGURATIONS p 159–167 (See N70-31008 16-21)
7. AN ANALYTICAL TREATMENT OF DELAYS AND DELAY COSTS. APPENDIX A 36 p (See N70-31009 16-02)

N70-31005*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
DESIRED CHARACTERISTICS HAZARD WARNING AND AVOIDANCE SYSTEM
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 2 May 1970 p 31–59 (See N70-31002 16-21)
Avail: CFSTI CSCL 17G

An airborne solution to the overall low visibility landing problems is considered. Three main system functions are required, which include a high ground avoidance capability, an independent approach and landing monitor, and a roll-out and taxi aid. The system functions and their economic and safety characteristics are described. R.B.

N70-31006*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
APPROACH AND LANDING AIDS
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 2 May 1970 p 60–80 (See N70-31002 16-21)
Avail: CFSTI CSCL 17G

Approach and landing systems currently in use and the relationship of these systems to the need for aircraft operations in low-visibility conditions are examined. The operation of the system as an approach and landing aid is explained, the operational limits of the system and the reasons for these limits are established, and the inherent difficulties in modifying the system to achieve low-visibility capability are pointed out. Author

N70-31007*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
SENSOR PERFORMANCE
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 2 May 1970 p 81–158 (See N70-31002 16-21)
Avail: CFSTI CSCL 17G

The performance evaluation for various sensors which might be used to meet the broad requirements for the functions of approach and landing aid, roll-out and taxi guidance, and high ground avoidance is presented. The sensors considered are radar and optical devices which would be suitable for installation in a commercial transport aircraft. Typical equipment parameters and space restrictions related to such an installation are included in hardware considerations. Radar sensors which operate at X-band (10GHz), Ku band (16GHz), Ka band (35GHz) and V band (70GHz) are considered. These radars are evaluated for their ability to detect runways, with and without enhancement, to detect high ground, and to perform other specific functions. Meteorological attenuation due to rain and fog is a primary factor in the evaluation. Optical sensors are included for both the visible region, 0.5 to 1.0 microns, and the infrared region near 10 microns. Author

N70-31008*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
SYSTEM CONFIGURATIONS
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 2 May 1970 p 159–167 (See N70-31002 16-21)
Avail: CFSTI CSCL 17G

System configurations are considered in which the major system elements, the interface between elements, and the overall functional performance capability are identified. Systems that have independent approach and landing monitors, roll-out and taxi aids, and high ground avoidance capabilities comprise a primary sensor which determines the position and presentation of a runway, its centerline, and the required touch-down point, high ground with respect to the aircraft velocity vector, a processor which converts, modifies, or operates on information derived by the sensor, and a display which is fed from the processor. Three system configurations are considered which range in complexity, size, and performance as a function of candidate user, the kinds of aircraft operated by the respective carriers, and the airfield environment into which they operate. Author

N70-31056*# JHS Engineering Co., Salem, N.H.
STUDY OF THE THERMAL DESIGN AND PERFORMANCE OF STRAPDOWN GUIDANCE AND CONTROL SYSTEMS
John H. Sununu May 1970 73 p
(Contract NAS12-2143)
(NASA-CR-86373) Avail: CFSTI CSCL 17G

Engineering assistance was provided in the thermal and mechanical design of three strapdown inertial sensing units: (1) an ISU containing three laser gyros for evaluation of laser inertial components; (2) an SRT/ISU for flight testing of such concepts as interchangeability of inertial components; and (3) an ERSA/ISU to evaluate the capabilities and advantages of using redundant inertial components. Author

N70-31072# National Aerospace Lab., Tokyo (Japan).
A MAGNETIC ATTITUDE MEASURING INSTRUMENT APPLYING THE HALL EFFECT
Shigeru Kimura, Johji Tabata, and Yoshitsugu Matsuzaki 1969 10 p refs In JAPANESE; ENGLISH summary
(NAL-TR-187) Avail: CFSTI

Sensing devices which detect the attitude of a vehicle in the terrestrial magnetic field using the direction sensitive properties of semiconductor Hall elements for lines of magnetic forces were produced experimentally. It is proved that Hall element consisting of InSb of 10 to 15 micron thickness has sufficient output voltage for application to a telemetry transmitting system by being placed between magnetic concentrators of high permeability material rods 25 millimeters or more in length and has excellent linearity with regard to direction sensitivity, with an angular uncertainty of one degree for the azimuth angle in the direction perpendicular to the meridian. Concentrators of permalloy PC whose coercivity is very small, brought about successful results in the frequency

characteristics of the sensing devices. The FRP enclosure vehicle hull which contains the sensing device did not affect the sensor's performance, but the steel enclosure of 1.8 millimeter thickness caused the sensitivity of the sensing device to decrease by 60%, while an iron block at a distance of 30 centimeters or more did not disturb the output signal of the sensing device. This attitude sensor is especially useful for a small rocket because of its tiny size and the very simple construction. Author

N70-31243# Litchford Systems, Northport, N.Y.
NEW DEVELOPMENTS IN SCANNING BEAM LANDING GUIDANCE SYSTEMS Final Report, Apr. - Oct. 1969
George B. Litchford Dec. 1969 252 p refs
(F33615-69-C-1110)
(AD-703717; L-AF-03; AFFDL-TR-69-107) Avail: CFSTI CSCL 17/7

The methodology and rationale for establishing significant design features of a new, radio-landing system are described. Multiple, microwave scanning beams define the precise coordinates of the touchdown conditions and permit a wide selection of curved, flared, or other flight path geometries that terminate in a safe landing condition. By time-sequencing wide-beams (scanning wide sectors) with narrow-beams (scanning narrow sectors), a coarse-fine solution to a vexing system design problem is offered. Precision guidance (for flareout, touchdown, and rollout) is provided as well as wide sector, proportional guidance data for noise abatement flight paths, steep angle approaches, and curved lateral paths. Users have the choice in the proposed systems signal formats of a low-cost implementation as well as a very sophisticated implementation that would be commensurate with high-performance jet aircraft. Typical design trade-offs of (1) C and K sub u band, (2) CW narrow-band data, (3) future channelization needs, (4) variable sampling rates, (5) guidance accuracies, and (6) the overall integrity of the system are analyzed. Several examples are given to illustrate the proposed methodology for arriving at a new signals in space standard for a common civil-military landing system. Illustrated are several configurations of the basic system exemplifying various user demands, aircraft types, costly lighting aids, safety levels, and redundancy of radio guidance. Author (TAB)

N70-31292# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
PRELIMINARY STUDY OF THE FEASIBILITY OF THE EUROPA 3B GUIDANCE SYSTEM. PART 2: SCHEMATICS [ETUDE PRELIMINAIRE DE FAISABILITE DU PILOTAGE D'EUROPA 3B. FASCICULE 2: LIEUX DE BLACK]
De Berranger, Boudet, and Barthelemy 17 Sep. 1969 114 p In FRENCH
(LRBA-NT-72/69/SEN/AS) Avail: CFSTI

Schematic drawings for the control mode of the Europa 3B guidance system are presented. Transl. by J.M.C.

N70-31507# National Aviation Facilities Experimental Center, Atlantic City, N.J.
LORAN-C COMPUTER EVALUATION Final Report
George H. Quinn Jul. 1970 100 p refs
(FAA-RD-70-23; FAA-NA-70-28) Avail: CFSTI

An evaluation has been completed of the AN/AYA-4 airborne, Loran-C hyperbolic coordinate converter, and general navigation computer. The AYA-4 accepted inputs from (1) Loran-C receiver, (2) Doppler navigator, (3) VOR, DME, and TACAN Systems and (4) dead reckoning information. Laboratory and flight tests were used in the evaluation. Flights were in a Coast Guard C-130 and an FAA KC-135 aircraft. Flights were tracked by an instrumentation radar unit to provide accuracy figures. A North Atlantic crossing was completed in the KC-135 where the North Atlantic and Norwegian Sea Loran-C chain was used. Test results showed that the AYA-4 Navigation Computer had the capability to provide guidance information to the pilot and to the automatic flight control system. The reliability of the AYA-4 computer needs much improvement before acceptance of the system can be seriously considered. Author

N70-31601*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
COMMERCIAL AIR TRANSPORT HAZARD WARNING AND AVOIDANCE SYSTEM. VOLUME 3: RADAR PERFORMANCE STUDIES Final Report
T. G. Thorne May 1970 81 p refs
(Contract NAS12-2108)
(NASA-CR-86394; PNSI-TR-70-0414-III) Avail: CFSTI CSCL 17G

CONTENTS:

1. INTRODUCTION p 1 - 4 (See N70-31602 16-21)
2. BACK SCATTERING FROM TERRAIN p 4 11 (See N70-31603 16-07)
3. ATTENUATION OF RADAR SIGNALS BY WEATHER AND THE RESULTING EFFECTS ON RADAR PERFORMANCE p 12 - 26 (See N70-31604 16-07)
4. BACKSCATTER FROM RAIN p 27 - 29 (See N70-31605 16-07)
5. VISIBILITY OF RUNWAYS WITH A MAPPING RADAR p 30 - 36 (See N70-31606 16-21)
6. SIGNAL LEVEL CALCULATIONS p 37 61 (See N70-31607 16-07)
7. INTERFERENCE p 62 - 69 refs (See N70-31608 16-07)

N70-31602*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
INTRODUCTION
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 1 - 4 (See N70-31601 16-21)
Avail: CFSTI CSCL 17G

Radar performance is derived in terms of range capability which is obtained by establishing desired ratios of signal levels and calculating the ranges at which these criteria are satisfied. Emphasis is placed on deriving a realistic basis for illustrating the important characteristics of a radar sensor and for choosing among the available frequency bands at which a radar might be operated. Author

N70-31606*# Polhemus Navigation Sciences, Inc., Burlington, Vt.
VISIBILITY OF RUNWAYS WITH A MAPPING RADAR
In its Com. Air Transport Hazard Warning and Avoidance System, Vol. 3 May 1970 p 30 - 36 (See N70-31601 16-21)
Avail: CFSTI CSCL 17G

It is well known that an airport runway can be seen on the PPI of an airborne radar, because the scattering coefficient of the runway is lower than that of the surrounding grassland. However, it is only seen when the angular resolution of the radar is high enough to pick out the relatively narrow runway. The maximum range at which it is detected depends upon the azimuth beamwidth of the radar antenna. The amplitude of the signal received at a given range is the sum of that from grass and from the runway, suitably weighted to take account of the polar diagram and of the different scattering coefficients. Author

N70-31694# Louisiana State Univ., Baton Rouge. Coll. of Engineering.
PROPORTIONAL NAVIGATION VERSUS AN OPTIMALLY EVADING CONSTANT SPEED TARGET IN TWO DIMENSIONS
Paul M. Julich and David A. Borg Jan. 1970 26 p refs
(Contract F44620-68-C-0021; Proj. Themis)

(AD-702821; THEMIS-LSU-T-TR-25; AFOSR-70-0727TR) Avail: CFSTI CSCL 17/7

The problem of evading a constant speed proportional navigation pursuer is considered. Both the evader and the pursuer are assumed to have limited lateral acceleration capabilities. A time lag is included in the pursuers guidance system. The problem of evasion is formulated as an optimal control problem with the performance criterion being the range at the point of closest approach. The type of evasive maneuver is shown to be dependent upon the initial relative positions of the target and pursuer. Typical trajectories for the target and evader are illustrated. Author (TAB)

N70-31908# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BALLISTIC MISSILE AIMING SYSTEMS
M. V. Efimov 16 Jan. 1970 131 p refs Transl. into ENGLISH of the book 'Pritselivanie Ballisticheskikh Raket' Moscow, Voyenizdat M-va Obor. SSSR p 1-119
(AD-704219; FTD-MT-24-422-69) Avail: CFSTI CSCL 17/7

The book is intended for soldiers, sergeants, and students in military schools, as well as for the general reader interested in missile technology. On the basis of Soviet and foreign sources the author gives an analysis of the aiming of ballistic missiles with the use of external as well as onboard information. Also presented is a discussion of gyroscopic units, tracking systems, and other information on the aiming of ballistic missiles. There is a bibliography of 14 titles. Author (TAB)

N70-31986*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A TEST OF THE EFFECT OF SATELLITE SPIN ON TWO-WAY DOPPLER RANGE-RATE MEASUREMENTS
John W. Marini May 1970 21 p refs Submitted for publication
(NASA-TM-X-63950; X-551-70-182) Avail: CFSTI CSCL 22C

It was predicted theoretically that the rotation of certain types of satellite antennas will cause a range-rate error in two-way Doppler tracking systems. When K is the effective turn-around ratio of the satellite transponder, lambda sub t is the wavelength of the ground based transmitter and f sub s is the satellite spin rate. This equation was tested experimentally by ground-based simulation. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-30623# Brookhaven National Lab., Upton, N.Y.
NEW TRENDS IN MULTICHANNEL PULSE DATA ANALYSIS
B. Soucek [1969] 45 p refs
(BNL-14442) Avail: CFSTI

New analyzing systems will have megachannel resolution without sacrificing speed of data collection. A survey and comparison of recent proposals to achieve this goal is given. The following systems and their basic principles of operation are described. The use of newly developed rotating memories; a disc system with fixed track addressing per rotation; random track addressing through programming; random track addressing using a special controller; disc buffered systems, with continuous updating; time of flight measurement through random modulation and cross-correlation; real time calculation of cross-correlation; the Fourier method. Author

N70-31163# Idaho Nuclear Corp., Idaho Falls.
FAST FLUX IRRADIATION FACILITY FOR THE ETR
E. Fast and G. J. Russell Mar. 1970 19 p refs
(Contract AT(10-1)-1230)
(IN-1350) Avail: CFSTI

The results of a study initially intended to provide a basis for design and fabrication of an experimental facility are presented. The facility was to be used in the ETR to provide fast flux irradiation of various materials. However, before the study was complete, the direction of the experimental program had changed, and it is expected that initial fast flux irradiations will be done in EBR-2. This study has shown the feasibility of providing fast flux irradiation for experiments in ETR, and may be used in the future as a basis for further studies. Author (NSA)

N70-31164# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Fuel Div.
CVTR FISSION GAS RELEASE
M. G. Balfour Jan. 1970 10 p refs
(Contract AT(30-1)-3850)
(WCAP-3850-5) Avail: CFSTI

Fission gas release data are summarized on 19 fuel rods irradiated in the Carolinas Virginia tube reactor. Three rods were from the regular CVTR core and had average burnups exceeding 14,000 MWD/MTU. The remaining rods were from experimental assemblies and had burnups less than 8,100 MWD/MTU. The design parameters of the rods are presented, and the fission gas analysis data, average burnup, full-power hours, peak power levels, fractional release of fission gases, and power distributions are tabulated. NSA

N70-31166# Reactor Centrum Nederland, Petten.
FAST REACTOR Progess Report, 1969
E. K. Hoekstra, comp. Feb. 1970 71 p refs
(RCN-177; QPR-3) Avail: CFSTI

The fast reactor programme deals with reactor physics, fuel performance, radiation damage and corrosion behavior in canning materials, aerosol research, and heat transfer and hydraulics. Author (ESRO)

N70-31183# Commissariat a l'Energie Atomique, Bouchet (France).
DETECTION METHOD FOR ALPHA-UO3H IN BETA-UO3 BY X-RAY DIFFRACTION [METHODE DE DOSAGE DE L'ALPHA-UO3(H) DANS LE BETA UO3 PAR DIFFRACTION DE RAYONS X]
Jacques Nicolas-Jarleton Feb. 1970 33 p refs In FRENCH; ENGLISH summary Prepared jointly with CNRS, Bellevue
(CEA-R-3958) Avail: CFSTI

In industry, ammonium uranate is thermally decomposed to give uranium trioxide. As UO3 comprises different crystal phases and hexagonal alpha-UO3 exists in industrial beta-UO3 - 0.5 H2O and as UO3 may affect the reduction reaction and reactivity of UO2 the various crystallographic phases in UO3 were investigated. An X-ray diffraction method for the dosage of alpha-UO3(H) in beta-UO3 is described. It 1) detects hexagonal alpha-UO3; 2) gives a semi-quantitative analysis with a threshold of 1.5% alpha-UO3 and 3) measures the alpha-UO3(H). ESRO

N70-31203# Argonne National Lab., Ill. Metallurgy Div.
POSTIRRADIATION EXAMINATION OF U-Pu-Zr FUEL ELEMENTS IRRADIATED IN EBR-2 TO 4.5 PERCENT BURNUP
W. F. Murphy, W. N. Beck, F. L. Brown, B. J. Koprowski, and L. A. Neimark Nov. 1969 61 p refs
(Contract W-31-109-eng-38)
(ANL-7802) Avail: CFSTI

Sixteen U-15 wt % Pu-10 wt % Zr metallic fuel elements

were irradiated to 4.5 at. % burnup at 10 kW/ft without failure. Cladding materials were Types 304L and 316 stainless steel, Hastelloy-X, and Hastelloy-X-280. The maximum cladding temperatures ranged from 605 to 650 C. Diametral and axial expansion of the cladding were both less than 0.3%. The fuel had swelled to the cladding, and 14 of the fuel columns elongated and two decreased in length. The interface between the fuel and the cladding showed evidence of a reaction between the two. The smallest reaction layer was in the Type 316 stainless steel. Annular zones had developed in the fuel. These zones are principally temperature dependent and are probably associated with phase transformations in the fuel. Fission products and major fuel constituents were found to have migrated between the three zones. Author (NSA)

N70-31205# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
BICYCL: A COMPUTER CODE FOR TWO-DIMENSIONAL ANALYSIS OF EQUILIBRIUM FUEL CYCLES
P. C. Vaughan, H. Butz, P. Greebler, B. A. Hutchins, M. D. Kelley et al Dec. 1969 225 p refs
(Contract AT(04-3)-189)
(GEAP-13556) Avail: CFSTI

The BICYCL computer program for calculating fast reactor fuel cycles is presented. The program is written in FORTRAN 4 for the GE-635 computer. The program computes spatially-dependent fuel isotopic compositions consistent with recycling of discharged fuel and reactivity requirements. First order perturbation theory is used to compute fuel cycle reactivity values. Program limitations are described. NSA

N70-31206# Los Alamos Scientific Lab., N.Mex.
SYNTHESIS AND FABRICATION OF PURE SINGLE-PHASE, URANIUM-PLUTONIUM MONOCARBIDE PELLETS
M. W. Shupe, A. E. Ogard, and J. A. Leary 19 Mar. 1970 11 p refs
(LA-4283) Avail: CFSTI

A process for producing pure, single-phase, (U,Pu)C solid solution pellets is described. Pellet dimensions, density, chemical composition, and microstructure were determined as functions of processing conditions. Author (NSA)

N70-31208# Los Alamos Scientific Lab., N.Mex.
DAC1: A ONE-DIMENSIONAL S SUB n PERTURBATION CODE
B. M. Carmichael 1 Apr. 1970 8 p refs
(Contract W-7405-eng-36)
(LA-4342) Avail: CFSTI

DAC1 uses fluxes from the DTF S sub n code to calculate reactivity perturbations, effective delayed neutron fractions, and generation times in reactors. The FORTRAN-IV programming techniques and input format of DTF are retained in DAC1. The reference reactor specifications are input to DAC1 by a direct reading of the DTF input deck; consequently, the only additional input needed is the perturbation specifications. Author (NSA)

N70-31214# Argonne National Lab., Ill.
EXPOSED-FUEL CALIBRATION STUDY IN EBR-2, SECOND SERIES
R. R. Smith, C. B. Doe, and E. R. Ebersole Jan. 1970 46 p refs
(Contract W-7405-eng-38)
(ANL-7558) Avail: CFSTI

Fission-product detection in the EBR-II system is annunciated by the FGM and FERD systems and by another method based on the radiometric assay of cover-gas samples Xe-133 and Xe-135. The FGM continuously monitors the concentrations of short-lived rare gases in the cover gas; the FERD senses the level of delayed-neutron-emitting fission products in a bypass coolant stream. The first two systems are on line and provide a continuous record for the respective index species. The third technique periodically analyzes samples for Xe-133 and Xe-135. Under normal operating conditions, each system registers a response porportional to the power level and to the degree of system contamination by tramp uranium. Author (NSA)

N70-31215# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A THREE-DIMENSIONAL DIFFUSION THEORY BURNUP CODE: 3DB
R. W. Hardie, and W. W. Little, Jr. Mar. 1970 150 p refs
(Contract AT(45-1)-1830)
(BNWL-1284) Avail: CFSTI

3DB is a three-dimensional (X-Y-Z, R-theta-Z, triangular-Z), multigroup diffusion code for use in detailed fast reactor criticality and burnup analysis. All programming is in FORTRAN-IV. Since variable dimensioning is employed, no simple restrictions on problem complexity can be stated. The code requires a 65k core and eleven peripheral storage units. Running time (for a k sub eff calculation) on a UNIVAC 1108 is about 1/2 hr for a 20 × 20 × 20 mesh problem using 2 energy groups. Each successive burnup time step takes about 1/4 of the above time. Author (NSA)

N70-31223# Oak Ridge National Lab., Tenn.
DESIGN, EQUIPMENT, AND PROGRAM FOR FUEL ROD BURST EXPERIMENTS
M. F. Osborne and G. W. Parker 2 Feb. 1970 27 p refs
(ORNL-TM-2850) Avail: CFSTI

Irradiated Zircaloy-clad fuel rods will be rupture tested to study the effects of irradiation on the failure characteristics of the cladding. A system was constructed in a hot cell, and burst experiments on both unirradiated and irradiated fuel rods are being conducted under conditions predicted for a Loss-of-Coolant Accident in a water cooled power reactor. Author (NSA)

N70-31239# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
FAILURE DATA HANDBOOK FOR NUCLEAR POWER FACILITIES. A GUIDE FOR THE DESIGN, CONSTRUCTION, AND MAINTENANCE OF NUCLEAR POWER PLANTS FROM A RELIABILITY IMPROVEMENT STANDPOINT. VOLUME 1: FAILURE DATA AND APPLICATIONS TECHNOLOGY
15 Aug. 1969 735 p
(Contract AT(04-3)-700)
(LMEC-Memo-69-7-Vol-1) Avail: HC$10.00/MF$0.65

Records on past unscheduled events with systems and components in liquid metal cooled facilities are presented. The events relate to construction schedule or cost, safety, availability, or maintainability of a nuclear power plant or test facility. Broad topics include: failures occurring during facility operation; adverse events occurring prior to startup; reliability and availability analysis; and maintainability. NSA

N70-31242# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS ON DEVELOPMENT OF MATERIALS AND TECHNOLOGY FOR ADVANCED REACTORS. Quarterly Report, Oct. – Dec. 1969
Jan. 1970 85 p refs
(Contract W-7405-eng-92)
(BMI-1878) Avail: CFSTI

A program to determine the effects of the magnitude and nature of reactor environments on various reactor cladding and structural materials is described. The portion of the program involving irradiation effects is directed toward obtaining an understanding of the radiation-induced high-temperature embrittlement observed in potential cladding materials for liquid-metal fast breeder reactors (LMFBR). Emphasis is being placed on the irradiation behavior of AISI Type 347 and Type 316 stainless steel. Physical properties

of importance for reactor design are being determined, including volatility tendencies, conductivity, expansivity, and chemical stability of the fuels in contact with potential LMFBR cladding materials. The resistance of nitride materials to both thermal and fast flux irradiations will be determined to evaluate the suitability of these fuels for applications involving long-term irradiations. The evaluation of sodium bonding of the fuel to the cladding is another objective of the program. A program to study the elevated-temperature creep behavior of fuels of interest for liquid-metal fast breeder reactors (LMFBR) is described. Author

N70-31253# Reactive Metals, Inc., Ashtabula, Ohio. Extrusion Plant.
[FUEL ELEMENT FABRICATION] Semiannual Progress Summary, Jul. – Dec. 1969
10 Feb. 1970 34 p refs
(Contract AT(30-1)-1405)
(RMI-14) Avail: CFSTI

Use of a straight mandrel was chosen as the best potential route for extrusion of I and E fuel elements. A mandrel design and material was selected and experiments have determined optimum extrusion parameters. A shrink fit die and holder assembly was used on production extrusion. Some difficulty was experienced with die closure, although an improvement in ovality was obtained. Additional extrusion lubricants were tested on the laboratory extrusion press. One commercial lubricant does show some potential of improving the extrusion surfaces. Work was performed on tests at increased ram speed and increased billet temperature, tests at increased ram speed only, tests with drop quenching; and tests at the reduced overstock level of 0.055 in. OD and 0.030 in ID. A production scale test of the precision extrusion process produced poor yields due to difficulty in die-sizing. Tooling size changes are being made because of the change to induction heat treatment. A group of special alloy uranium 4 wt. % niobium billets was extruded on the 360 ton laboratory press. Author (NSA)

N70-31254# Du Pont de Nemours (E. I.), and Co., Aiken, S.C. Savannah River Lab.
OPERATING PHILOSOPHY AFTER 12 REACTOR-YEARS EXPERIENCE WITH ON-LINE COMPUTERS
K. L. Gimmy [1969] 12 p refs Presented at Conf. on Reactor Operating Experience, San Juan, Puerto Rico, 1-3 Oct. 1969
(Contract AT(07-2)-1)
(DPSPU-69-30-18; Conf-691009-8) Avail: CFSTI

The Savannah River Plant (SRP) is a U. S. Atomic Energy Commission production facility. Three large reactors are each equipped with an on-line digital computer that has 3450 analog inputs and is used by the operating group 24 hours per day. SRP interest in reliability and operator acceptance closely parallels that of a power reactor. There is also technical program that results in new applications for the computers. The guidelines that have been evolved for four types of computer-reactor applications are summarized. Three problem areas and some suggested solutions are described. Author (NSA)

N70-31246# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE IODINE COLLECTION EFFICIENCY OF ACTIVATED CHARCOAL FROM HANFORD REACTOR CONFINEMENT SYSTEMS: METHYL IODIDE RETENTION BY ACTIVATED CHARCOAL
J. D. Ludwick Jul. 1969 27 p refs
(Contract AT(45-1)-1830)
(BNWL-1046) Avail: CFSTI

Activated charcoal is used in the gas confinement system of Hanford's nuclear reactors and it is necessary that their iodine adsorption ability be precisely determined to ensure operational safety. Adsorption measurements were taken while subjecting these charcoals to stress. The results were compared with those obtained from new, unused products, and an estimate was made of the loss in iodine trapping efficiency. Adsorption tests, using both methyl iodide and iodine, were also conducted on fresh charcoal to measure the effectiveness of some of the newer commercially available products. The purpose of these tests was to aid in the selection of activated charcoal for replacement in the reactors or for use in future reactor confinement systems. Author (NSA)

N70-31261# Atomic International, Canoga Park, Calif.
FUELS, MATERIALS, AND COOLANT CHEMISTRY PROGRAMS Quarterly Technical Progress Report, Oct. – Dec. 1969
E. W. Murbach and D. F. Atkins 15 Feb. 1970 84 p refs
(Contract AT(04-3)-701)
(AI-AEC-12913) Avail: CFSTI

Progress is reported on research and development in materials management, radiation effects on reactor materials, determination of radioinduced helium distribution and effects in reactor materials, characterization of mixed carbide fuels, solvent properties of sodium for reactor materials, and distribution of radioisotopes between liquid sodium and containment materials. NSA

N70-31295# Reactor Centrum Nederland, Petten.
PREPARATION OF TUNGSTEN COATED DYSPORSIA AND ITS INCORPORATION IN URANIUM DIOXIDE
E. B. M. Major Feb. 1970 31 p refs
(RCN-115) Avail: CFSTI

Dysprosium trioxide may be applied as burnable poison in UO2 fuel elements. To prolong the effect it is necessary to use discrete Dy203 particles with neutron shelf-shielding, but dissolution of the Dy203 particles in the surrounding mattrix must be avoided. The preparation of spherical Dy203 particles coated with tungsten as a reaction barrier is described. The Dy203 particles were stabilized with Y203, spheriodized in an argon plasma torch and coated by a vapor deposition process in a fluid bed furnace. Experiments showed that the coated particles were compatible with UO2 to above 2000 C. Author (ESRO)

N70-31312# Douglas United Nuclear, Richland, Wash.
ACTIVATED CHARCOAL FILTER HISTORY OF THE HANFORD SINGLE PASS PRODUCTION REACTORS FROM MARCH 1968 TO THE PRESENT TIME
J. E. Mecca Oct. 1969 25 p refs Presented at the Oct. Conf. of the Am. Nucl. Soc., San Juan, Puerto Rico, Oct. 1969
(Contract AT(45-1)-1857)
(DUN-SA-116; Conf-691009-6) Avail: CFSTI

During the replacement of some damaged particulate filters, a visual inspection revealed damaged charcoal filter units. Several of these filters were removed and tested for absorption efficiency. These test results led to an inspection of all installed charcoal filters at the C, KE, and KW reactors and a decision to renovate all charcoal filters at these reactors. The Hanford reactors confinement systems are described, and the field inspections, laboratory filter tests, and laboratory absorption efficiency tests on charcoal samples are discussed. NSA

N70-31313# Bettis Atomic Power Lab., Pittsburgh, Pa.
COMPARISON OF DIMENSIONAL CHANGES IN FUEL RODS WITH PREDICTIONS UNDER CYCLIC CONDITIONS OF POWER AND SYSTEM PRESSURE (LWBR DEVELOPMENT PROGRAM)
E. Duncombe and I. Goldberg Mar. 1970 24 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-940) Avail: CFSTI

The various additions to the CYGRO fuel rod analysis technique in order to calculate ratchetting effects are described. These effects include fuel cracking, clad collapse, friction between fuel and clad, clad anisotropy, and effects of neutron flux on clad creep. By

reasonable choice of parameters good agreement can be obtained with tests on axial elongations of non-freestanding fuel rods. There is a pronounced sensitivity of these predictions to the value of creep enhancement as a result of neutron flux. Predictions of diameter changes are believed to be inherently less accurate because of the masking effects of ridging, wrinkling, and clad collapse. Author (NSA)

N70-31329# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

PACIFIC NORTHWEST LABORATORY DIVISION OF ISOTOPE DEVELOPMENT PROGRAMS Quarterly Report, Nov. 1969 - Jan. 1970

W. F. Sheely, ed. Mar. 1970 42 p refs
(Contract AT(45-1)-1830)
(BNWL-1308-1) Avail: CFSTI

The experimental evaluation of Pm(147)2O3 compatibility with capsule materials was completed. The compatibility testing of various containment materials with Sm metal was continued. The program on encapsulated waste management Cs as a process radiation source was redirected toward improved design of waste containers for efficient use as irradiation sources. Reconsideration of the shielding analysis showed that the quantitative evaluation of the effective source must be on the basis of target geometry as well as source geometry. Studies of methods for the nondestructive testing of irradiation sources concentrated on the development of a multielement, ultrasonic transducer which will permit scanning of wide paths in large, flat surfaces (such as plate-type irradiation sources) for internal defects. The electronic circuitry for signal generation, signal amplification, and transducer scanning was designed, built, and tested. NSA

N70-31342# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

FAST REACTOR FUEL PERFORMANCE MODEL DEVELOPMENT

A. Boltax, P. Murray, and A. Biancheria Feb. 1970 28 p refs
(Contract AT(30-1)-4135)
(WARD-4135-3) Avail: CFSTI

The status of fast reactor fuel performance model development, involving the OLYMPUS and CYGRO-F codes is reviewed. Input information in several critical areas is examined including the swelling, irradiation creep, and ductility of stainless steel cladding, and the swelling and plasticity of mixed oxide fuel. The predictions from the two codes are illustrated by parametric studies and application to high fluence/burnup ratio fuel rods of interest to the Liquid Metal Fast Breeder Reactor Program. Author (NSA)

N70-31354# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.

DESIGN, CONSTRUCTION, AND EVALUATION OF A FACILITY FOR THE SIMULATION OF FAST REACTOR BLANKETS

I. A. Forbes, M. J. Driscoll, T. J. Thompson, I. Kaplan, and D. D. Lanning Feb. 1970 125 p refs
(Contract AT(30-1)-4105)
(MIT-4105-2; MITNE-110) Avail: CFSTI

A large converter assembly, consisting of a 20-cm-thick layer of graphite followed by a 17.5-cm-thick UO2 fuel region, is used to convert thermal neutrons into fast neutrons to drive a blanket mockup. Operating at 55 watts, the converter generates blanket fluxes at an equivalent LMFBR core power of about 350 watts, with as little as one-tenth of the blanket material required for a critical assembly. Calculations show that the converter leakage spectrum is a close approximation to the core leakage spectrum from reference LMFBR designs, and that the axial distribution of the neutron flux in the blanket assembly simulates that in the radial blanket of a large LMFBR when the effective height and width of the blanket assembly are correctly chosen. Testing of the completed facility with a blanket composed of 50 v/o iron and 50 v/o borax show that the lateral flux distributions are cosine-shaped, and that lateral spectral equilibrium is achieved in a large central volume of the blanket. Backscattering from concrete shielding surrounding the experiment was found to affect no more than the outer 30 cm of the blanket assembly, confirming the results of two-dimensional multigroup calculations. Author (NSA)

N70-31357 National Lending Library of Science and Technology, Boston Spa (England).

ON THE FUEL ELEMENT PROBLEMS OF THE STEAM-COOLED FAST BREEDER REACTOR

L. Ritz 1970 9 p Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), v. 14, no. 4, Apr. 1969 p 207 - 210
(NLL-Risley-Trans-1740-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Fuel element concepts are discussed in the framework of future programs for the development of steam cooled fast breeder reactors. Three subject areas are presented. They are: function of the spiral fins, reduction of nuclear inventory, and loading capacity of the sheathing material. F.O.S.

N70-31359# General Electric Co., San Jose, Calif. Reactor Fuels and Reprocessing Dept.

ZIRCALOY-CLAD UO2 FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, Aug. - Oct. 1969

F. H. Mergerth, comp. Nov. 1969 19 p refs
(Contract AT(04-3)-189)
(GEAP-10121; QPR-8) Avail: CFSTI

The irradiation of Assembly SA-1 was terminated in September 1969, after 1800 days of VBWR and Dresden operation. Post-irradiation leak testing of the assembly indicated that it is sound. A number of high temperature tensile tests were run on longitudinal coupon cladding specimens in which the specimens were held at the test temperatures for periods longer than the normal 15-minute soaking time before tension was applied. Holding specimens at 343 C tensile properties. However, a specimen held for 16 1/2 hours at 300 C showed ultimate and yield strengths lower than any specimen tested at 399 C by the normal precadure, and, in addition, it showed somewhat greater uniform and total elongations. The 454 C tensile properties of the irradiated cladding apprently were not affected significiantly by increasing the soaking time to 1 hour at that temperature. The ultimate strengths of three irradiated specimens held at 454 C for 16 1/2 hours before testing approached that of the unirradiated material These same specimens showed wide variations in elongation. Author (NSA)

N70-31368# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

HEROIC: A NEW METHOD FOR CLUSTER-TYPE FUELLED LATTICE CELL CALCULATIONS

R. Cuniberti and Cl. Daolio 1970 60 p refs
(EUR-4464.e) Avail: CFSTI

The HEROIC code described in this report is a cell code which solves the integral transport equation in a 39 groups structure, using the first collision probability formalism. Collision probabilities are calculated by means of the CLUCOP subroutine developed by Carlvik which deals with a two dimensional cluster geometry. The code is substantially based on the PINOCCHIO scheme but it is not limited to the description of a restricted number of fixed geometries, and clusters can be treated without any homogenization. The machine time on the IBM-360 is typically of the order of 10 minutes. The results of the code are compared with fine structure measurements performed at Ispra and elsewhere and it is shown that thermal activation distributions are well reproduced. Author

N70-31378# California Univ., Livermore. Lawrence Radiation Lab.

CONTROLLED THERMONUCLEAR RESEARCH Annual

Report, Jul. 1968 – Jun. 1969
11 Sep. 1969 210 p refs
(UCRL-50002-69) Avail: CFSTI

Reports on continuing research are presented. Theoretical and experimental studies were made on computer simulation, magnetic mirrors, Astron program, toroidal confinement, nonlinear dynamics, plasmas, and atomic cross sections. N.E.N.

N70-31385# Mound Lab., Miamisburg, Ohio.
A HIGH-TEMPERATURE X-RAY STUDY OF Pu(238) O2 PLASMA-FORMED MICROSPHERES
R. J. De Sando, W. C. Wyder, R. R. Eckstein, and W. R. Amos
20 Mar. 1970 11 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1690) Avail: CFSTI

A high-temperature x-ray study of Pu-238O2 microspheres (50 to 250 micro m in diameter) produced from an rf induction-coupled plasma torch has been conducted in the temperature interval of 14 to 1505 C. The lattice parameters obtained at 22 different temperatures exhibit linearity up to about 675 C and expand in a normal fashion up to 1137 C. The expansion curve undergoes anomalous behavior at 1137 C, which is attributed to a major fraction of helium (produced from alpha emission) being released and removed of configurational defects by annealing. The lattice parameters of the Pu-238O2 microspheres are slightly larger than the parameters of Pu-238O2 powder because of radiation damage and helium entrapment. Fourth-degree polynomial expressions as functions of temperature for the lattice parameter (a), instantaneous coefficient of thermal expansion (alpha sub 1) , and fractional changes in the lattice parameter (delta a/a) are presented. Mean square atomic vibrational amplitudues were computed from the thermal expansion data using Grüneisen's theory, and exhibit an increase with temperature as expected. Author (NSA)

N70-31389 National Lending Library for Science and Technology, Boston Spa (England).
PHENIX: SAFETY PROBLEMS
F. Lichtenberger et al 1970 11 p Transl. into ENGLISH from Bull. Inform. Sci. Tech. (Paris) no. 138, Jun. 1969 p 105 – 111
(NLL-Risley-Trans-1878-(9091.9F) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The safety measures taken for the large fast sodium cooled reactor are reviewed. The danger areas are identified as the plutonium in the core, the large quantities of sodium in primary and secondary circuits, and the blanketing argon which may become highly contaminated. Procedures are described to prevent primary reactivity accidents, cooling accidents, and risks due to leaks of argon, sodium, and water. Specific supplementary safety devices include thermocouples on the core cover, reactivity meters, and automatic shutdown devices. The possibilities of nuclear explosion and earthquakes are also considered. N.E.N.

N70-31411# California Univ., Berkeley. Lawrence Radiation Lab.
RADIATION STUDIES AT A MEDIUM ENERGY ACCELERATOR
Lloyd D. Stephens and Alvin J. Miller Oct. 1969 47 p refs Presented at 2d Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif.
(Contract W-7405-eng-48)
(UCRL-19386; Conf-691101-16) Avail: CFSTI

Effective attenuation lengths were measured through the shielding walls at several angles from the target at the Berkeley 88-inch cyclotron. Attenuation of neutrons was measured for walls composed entirely of concrete, as well as of concrete and iron, or of concrete, iron, and sand. Variations in shielding efficiency were determined. Neutron flux measurements have been made along an extended beam line in an effort to improve beam transport and reduce personnel irradiation. Also, extensive activation studies of many accelerator parts were made. These studies prove their worth in maintenance planning, for which it is desirable to minimize personnel exposures. A sampling of the measurements of the external radiation field produced by the accelerator is presented including external surveys during machine operation for personnel protection and for compliance with AEC requirements; internal surveys and activation studies, both for improved machine maintenance and for personnel protection from induced activity during machine shutdown; and target yield and angular distribution studies, and studies of shielding materials, for cyclotron development programs. NSA

N70-31448# Oak Ridge National Lab., Tenn.
NUCLEAR SAFETY PROGRAM Annual Progress Report, Period Ending 31 Dec. 1969
Mar. 1970 233 p refs
(Contract W-7405-eng-26)
(ORNL-4511) Avail: CFSTI

These general studies include fuel rod failures, aerosol filtration and adsorption technology, spray and pool-suppression technology, pressure vessel and piping technology, fuel transport criteria, RDT reactor standards, antiseismic design of nuclear facilities, and the Nuclear Safety Information Center. However, at the present time several of these studies are directed toward the immediate siting and/or safety problems of a specific reactor type. Author

N70-31452# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
LOFT PROGRAM OFFICE Quarterly Technical Report, 1 Apr. – 30 Jun. 1969
K. A. Dietz, ed. Mar. 1970 123 p refs
(Contract AT(10-1)-205)
(IDO-17303) Avail: CFSTI

Progress is reported on performance of stainless steel containment structure under effects of iodine and methyl iodide penetration, the effects of blowdown conditions on performance of pressurized water reactor heat transfer systems, the effects of burnup on fission gas release in uranium oxide fuel elements, calculation and measurement of pressure profiles during blowdown in LOFT scale model tests, and the effects of pressurized water reactor coolant loss conditions on tubes of zircaloy-4. NSA

N70-31453# Oak Ridge National Lab., Tenn. Isotopes Div.
ORNL ISOTOPIC POWER FUELS Quarterly Report, Period Ending 31 Dec. 1969
Eugene Lamb Mar. 1970 20 p refs
(Contract W-7405-eng-26)
(ORNL-4533) Avail: CFSTI

All equipment for the Curium Source Test was completed. Equipment assembly and in-cell installation was begun. Fueling of the source is expected to be accomplished in early February. Metallographic examination of Cm(244)2O3 compatibility capsules of Ta, Ta – 10% W, T-111, Mo, TZM, W, and W – 26% Re exposed for 5000 hr at 1850 C indicates there has been considerable migration of the fuel inside the capsule. The SNAP-23 generator was shipped. An alternative conceptual design of the SNAP-23 capsule is being developed as the basis for a cost estimate of source fabrication operations. The effect of aging on the impact properties of superalloys is being determined. Hastelloy N and Haynes Developmental alloy No. 188 evaporation rates were measured at 800 to 1050 C and 10 to the minus 9th power torr to determine their suitability for use in high vacuum. A joint between platinum and tantalum alloys for extended use in vacuum at elevated temperatures is being developed. Author (NSA)

N70-31483# European Atomic Energy Community, Petten (Netherlands). Joint Research Center.
A METHOD FOR DETERMINATION OF CONVERTIBLE NUCLEAR HEATING DATA
H. Kroeckel 1970 44 p refs
(EUR-4415.e) Avail: CFSTI

The nuclear heat generation process is analyzed and presented in well-known form as function of the neutron and gamma energy distributions. The energy distributions are approximated by expressions containing three unknown linear constants in the heating equation. By setting up this equation for three different materials, a system of three linear equations is obtained, the coefficients of which are computable functions. The solution of this system is presented in terms of experimentally determined nuclear heating values of the three materials. The known solution can be used for calculation of nuclear heating data for any desired sample size and material by the same linear expression. Numerical coefficients of this expression are given for materials C, Be, Mo and Fe as function of sample size. A test rig, CADO-17 for measurements in the High Flux Reactor (HFR) at Petten is described; the chosen sample materials are C, Be and Mo. Author

N70-31491# Bettis Atomic Power Lab., Pittsburgh, Pa.
PRESSURIZED WATER REACTOR PROJECT Technical Progress Report, 26 Jul. – 24 Oct. 1969
24 Oct. 1969 24 p
(Contract AT(11-1)-GEN-14)
(WAPD-MRP-130) Avail: CFSTI

The first Core 2, Seed 2, 150 MW(e) demonstration test in the Shippingport reactor was successfully performed. Initial Core 2 operations with Seed 2 have resulted in an indicated total flow decrease of about 2%, but recent measurements indicate that the flow appears to have stabilized. As expected the reactivity loss rate inferred from measurements indicates a slightly positive value at about 120 EFPH, but by 300 EFPH had reversed to a slightly negative reactivity loss rate. A primary to secondary tube leak was detected in the D steam generator. Author (NSA)

N70-31493# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
REACTIVITY EFFECTS OF Xe 135 AND Sm 149 IN MIXED LATTICES AFTER SHUTDOWN
F. D. Benton and F. C. Enzbrenner Sep. 1969 9 p refs
Presented at Conf. on Reactor Operating Experience, San Juan, Puerto Rico, 1 - 3 Oct. 1969
(Contract AT(07-2)-1)
(DPSPU-69-30-10; Conf-691009-7) Avail: CFSTI

The effect of the principal fission products, Xe-135 and Sm-149, on production reactor operation is analyzed. The method by which the reactivity effects of the fission products are calculated is presented. Author (NSA)

N70-31504 National Lending Library for Science and Technology, Boston Spa (England).
CENTRIFUGAL EXTRACTORS FOR THE REPROCESSING OF NUCLEAR FUELS WITH HIGH BURNUP AND PLUTONIUM CONTENT
B. Roth 1970 15 p Transl. into ENGLISH from German rept. KFK-862
(NLL-Risley-Trans-1895-(9091.9F); KFK-862) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The problems connected with recovery of fuel elements from fast breeder reactors are considered. Centrifugal extractors are shown to be superior to mixed settlers and pulsed extractor columns in overcoming problems of radiation dosage and burnup. R.B.

N70-31505# Ente Nazionale per l'Energia Elettrica (ENEL), Rome (Italy).
OPEN-VESSEL EXPERIMENTS ON PLUTONIUM PROTOTYPE ELEMENTS IN THE GARIGLIANO REACTOR
A. Ariemma, L. Bramati, U. Cammarota, M. Galliani, A. Gibello et al (CNEN, Rome) 1970 73 p refs
(Contract EURATOM-092-66-8-TEEI)
(EUR-4475.e) Avail: CFSTI

During the last shutdown of the Garigliano reactor for refuelling a series of critical experiments were performed on assemblies containing reload enriched-uranium elements and prototype plutonium elements. The outcome of these experiments was information on the rod power density distributions associated with highly heterogeneous lattices and reactivity variations following replacement of enriched uranium elements with plutonium elements. The technique used for power density measurements (gamma activity scanning by means of a NaI crystal) proved its outstanding capabilities, because it revealed minor effects on the power densities, such as those due to rod manufacturing tolerances. The good agreement observed in previous criticality experiments between the experimental values and those obtained with the calculation methods adopted by ENEL in the design of plutonium prototype fuel elements was fully confirmed. The power density was calculated with a standard deviation less than 2% and reactivity with an error below 0.5%. Author

N70-31526# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
MOLTEN FUEL MOVEMENT IN TRANSIENT OVERPOWER TESTS OF IRRADIATED OXIDE FUEL
T. Hikido and J. H. Field Sep. 1969 44 p refs
(Contract AT(04-3)-189)
(GEAP-13543) Avail: CFSTI

Results are presented on an experimental program in which were investigated the effects of molten fuel movement and fission product gases (using prototypic fuel and blanket lengths) on transient failure energy thresholds and mechanisms. Two experimental capsules were operated, first in the GETR (steady-state) and then in the TREAT (transient) facilities. The slightly enriched UO2 fuel specimens, 0.250-inch o.d. and stainless steel clad, were compared with regard to fuel temperatures, mechanical deformations, and post-irradiation appearance. Provision for accommodation of molten fuel expansion and for internal pressure relief significantly increased the energy threshold for failure of irradiated oxide fuel pins caused by power transients. Author

N70-31580# Picatinny Arsenal, Dover, N.J.
RADIATION-INDUCED NITRATION OF BENZENE WITH DINITROGEN TETROXIDE
Andrew F. Smetana and Thomas C. Castorina Mar. 1970 39 p refs
(AD-702924; PA-TR-3915) Avail: CFSTI CSCL 7/5

The gamma-radiation-induced nitration of benzene with dinitrogen tetroxide (N2O4) in the liquid phase at 20C yielded nitrobenzene (NB) as the major product and the isomerides of dinitrobenzene (DNB) as the minor products of radiolysis. The yield G(NB) increased with increasing concentration of N2O4 from 0.14 for 8 mole % N2O4 to 1.18 for 95 mole % N2O4 in benzene. The ratio of o- to p-DNB is the inverse of that obtained from conventional mixed acid nitration and is considered typical of radiolysis. The nitro-substitution product formations are shown to be from primary processes of radiolysis and are proposed as being derived from an intermediate specie involving an No2.C6H6H(+) pi-donor complex. The NO2 in equilibrium with the N2O4 in the liquid phase is regarded as the nitrating agent in the form of a radical as well as a nitronium ion (NO2(+)). Both water and

nitrous acid as secondary products of radiolysis are suggested as anti-catalysts inhibiting the degree of the radiation-induced nitration.
Author (TAB)

N70-31593# Atomic International, Canoga Park, Calif.
LARGE RADIOISOTOPE HEAT SOURCE CAPSULE (LRHSC) Quarterly Progress Report, Oct. Dec. 1969
6 Feb. 1970 113 p
(Contract AT(29-2)-2338)
(AI-AEC-12926; QPR-10) Avail: CFSTI

Activities in a program to develop an isotope fuel capsule capable of operation in space at a surface temperature of about 2000 F are summarized. Progress is reported on hardware design, capsule testing, and material compatibility testing. Efforts devoted to the various phases of the transient capsule support program are reported.
NSA

N70-31596# Battelle-Northwest, Richland, Wash. Applied Physics Dept.
DOWNWARD VACUUM VAPOR DEPOSITION OF RARE EARTHS ONTO HOLLOW MICROSPHERES
W. J. Coleman Feb. 1970 23 p refs
(Contract AT(45-1)-1830)
(BNWL-1288) Avail: CFSTI

Development of a method to contain polonium for isotopic heat source application, involved a process for deposition of a 6 micron uniform rare earth coating onto 0.006-in.-diameter spheres. Procedures developed to deposit uniform rare earth coatings using vacuum vapor techniques are described. Information and discussion are included on developing techniques to evaporate and monitor thick rare earth coatings, obtain proper sphere movement for uniform coatings, prevent oxidation of the rare earth film, and determine routine coating procedures.
Author (NSA)

N70-31700# Naval Research Lab., Washington, D.C. Reactor Materials Branch.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Nov. 1969-31 Jan. 1970
L. E. Steele, J. R. Hawthorne, C. Z. Serpan, Jr., F. A. Smidt, Jr., and H. E. Watson 15 Sep. 1970 51 p refs
(AD-703617; NRL-MR-2088) Avail: CFSTI CSCL 18/10

The report covers research for the period 1 November 1969-31 January 1970, includes: (1) demonstration of improved radiation embrittlement resistance in commercial scale melt of Type A533-B pressure vessel steel, (2) an outline of the effects of fast reactor environment on selected structural and cladding alloys, (3) correlation of dynamic tear, Charpy-V, and drop-weight results from irradiation in a power reactor, (4) neutron exposure of Army SM-1 reactor vessel and related embrittlement projections, (5) initial results of examining radiation sensitive steels by transmission electron microscopy, and (6) description of a newly developed automated system for fatigue crack propagation studies on irradiated metals.
Author (TAB)

N70-31724# Stanford Univ., Calif. High Energy Physics Lab.
RECIRCULATION AT THE STANFORD HIGH ENERGY PHYSICS LABORATORY
Eifionydd Jones Aug. 1969 40 p refs
(Contract Nonr-225(67))
(AD-703242; SU-HEPL-609)

The length of the superconducting electron accelerator under construction at the High Energy Physics Laboratory is limited to some 500 feet. A conservative estimate of the final beam energy would then appear to be 2 GeV. The newest end-station, with very little rearrangement of the presently envisaged layout of experimental apparatus, may easily contain a 74 ft diameter 180 degrees bending magnet system. A second 180 degrees bend tunneled underneath the H.E.P.L. offices would then complete the return path of the beam so that it may be injected at least once more into the accelerating structure to gain a final energy of about 4 GeV. The feasibility of such a recirculating scheme is studied in the paper. The final chapters of the report contain some ideas, in outline only, of how multiple recirculations might be achieved in fixed field superconducting magnets.
TAB

N70-31725# Stanford Univ., Calif. High Energy Physics Lab.
A POLARIZED Co 59 TARGET USING He 3-He 4 DILUTION REFRIGERATOR
J. S. Mc Carthy, R. Whitney, D. C. Healey, D. Parks, and T. R. Fisher (LMSC, Palo Alto, Calif.) Nov. 1969 17 p refs Sponsored in part by NSF
(Contract Nonr-225(67))
(AD-703241; SU-HEPL-619) Avail: CFSTI CSCL 20/7

A 3He-4He dilution refrigerator has been used to cool a 32 gram polycrystalline cobalt rod to 0.034 degrees K. The rod is held in a longitudinal magnetic field of 6.5 kOe and has a nuclear polarization of 0.38. The cobalt piece will be used to study the scattering of polarized and unpolarized fast neutrons from polarized 59Co.
Author (TAB)

N70-31727# Hittman Associates, Inc., Columbia, Md.
ADDENDUM TO PM-3A HAZARDS ANALYSIS REPORT, TYPE 4 CORE
Feb. 1970 63 p refs
(Contract AT(30-1)-3775)
(HIT-3775-01-Add; HIT-340-Add) Avail: CFSTI

The safety of operation of the PM-3A Type 4 Core has been analyzed for various potential nuclear accidents and secondary system transients. Also, the fission product inventory has been accurately determined at the end of life. In all analyses, the nuclear parameters have been determined based on the PM Type 4 Core design reports and technical manuals for the PM-3A plant.
Author (NSA)

N70-31754# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Siebersdorf.
MEASUREMENTS ON THE BERYLLIUM REFLECTED CORE OF THE ASTRA REACTOR [MESSUNG AM BERYLLIUMREFLEKTIERTEN CORE DES ASTRAREAKTURS]
A. Burtscher Feb. 1970 15 p refs In GERMAN Submitted for publication
(SGAE-R-4/1970) Avail: CFSTI

Compared are graphite and beryllium reflecting elements for changes in dimension caused by radiation effects. A four by seven core arrangement with a row of reflecting beryllium elements along both sides increased reactivity by about 4 percent when compared with a graphite reflector arrangement. The (gamma,n) and the (n,2n) reaction with beryllium increased the neutron level in the shutdown core so much that direct current lines were still faintly active enven after prolonged cut-off. Direct current channels achieved several hundred Watt when the reactor came close to criticality. Neutron flux measurements on the beryllium reflector in the core center show that the share of fast neutrons at the pipe exit decreased by a factor of three to four.
Transl. by G.G.

N70-31792# Scientific Translation Service, Ann Arbor, Mich.
FAST FISSION IONIZATION CHAMBER [BYSTRAYA IONIZATSIONNAYA KAMERA DELENIYA]
V. N. Kononov et al [1969] 10 p refs Transl. into ENGLISH from Russian report FEI-143 Sponsored by AEC Prepared for ANL
(ANL-Trans-819; FEI-143) Avail: CFSTI

A fast pulse fission chamber was designed which permits registering with high efficiency fission fragments in the presence

of a large background of alpha particles. Increased speed of action of the chamber was achieved as a result of direct use of current pulses forming in the chamber during the registration of charged particles and subsequent amplification of their discrimination by means of pulsed broad-band current devices. The chamber, containing 75 mg of Pu-239 has an efficiency of about 75%. The low intensity of the pulse front permits using the detector in experiments with nanosecond resolution. Author (NSA)

N70-31812# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.

FAILURE DATA HANDBOOK FOR NUCLEAR POWER FACILITIES. A GUIDE FOR THE DESIGN, CONSTRUCTION, AND MAINTENANCE OF NUCLEAR POWER PLANTS FROM A RELIABILITY IMPROVEMENT STANDPOINT. VOLUME 2: FAILURE CATEGORY IDENTIFICATION AND GLOSSARY

20 Jun. 1969 191 p
(Contract AT(04-3)-700)
(LMEC-Memo-69-7-Vol-2) Avail: CFSTI

Records on past unscheduled events with systems and components in liquid metal cooled facilities are presented. The events relate to construction schedule or cost, safety, availability, or maintainability of a nuclear power plant or test facility. Broad topics include: system or component and failure category identification; and glossary. NSA

N70-31842# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

PRECIPITATION FROM COOLING TOWERS IN COLD CLIMATES

Thomas J. Overcamp and David P. Hoult May 1970 34 p refs
(Grant NIH 1-ROI-AP-00-67-02)
(Publ-70-7) Avail: Issuing Activity CSCL 18/5

A model is proposed for determining the conditions under which precipitation can occur from a natural draft cooling tower. Because the time scale for forming rain drops is large compared to the average residence time of droplets in the plume, there is no precipitation unless the plume mixes with the aerodynamic wake of the tower and is brought to the ground as light precipitation. A simple theory gives the heat transfer and the flux of water vapor emitted by the cooling tower. Equilibrium thermodynamics of mixing processes are used to calculate how much water vapor condenses as the plume is diluted with the surrounding air. Scaled experiments in a towing tank defined, in dimensionless variables, the conditions under which the plume will interact with the wake and strike the ground. A turbulent diffusion model combined with the thermodynamics of mixing is used to estimate the precipitation. These calculations show that precipitation will only be significant in cold weather when it can be a tenth of a centimeter per hour. Author

N70-31868# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.

LIQUID METAL ENGINEERING CENTER (LMEC) Semiannual Technical Progress Report, Jul. – Dec. 1969

5 Mar. 1970 217 p refs
(Contract AT(04-3)-700)
(LMEC-70-1) Avail: CFSTI

Activities in programs devoted to support of LMFBR development are reported. Research and development efforts are summarized for projects on sodium-water reactions, components test installation operation, sodium pump test facility development, sodium pump operation technology, materials compatibility in sodium, heat exchanger performance, instrument development and calibration, chemistry and metallurgy, and maintenance and malfunctions. NSA

N70-31872*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ESTIMATES OF FUEL CONTAINMENT IN A COAXIAL FLOW GAS-CORE NUCLEAR ROCKET

Henry A. Putre 1970 20 p refs Presented at 16th Ann. Meeting of the Am. Nucl. Soc., Los Angeles, 28 Jun. – 2 Jul. 1970
(NASA-TM-X-52838) Avail: CFSTI CSCL 18E

The main fluid mechanics problem in the rocket engine is that of predicting the contained fuel mass for various propellant-to-fuel flow ratios. The analysis described here calculates a dimensionless fuel mass, called the fuel volume fraction. This analysis uses a coaxial free-jet computer code, and eddy viscosity equations that had been developed for this code. The analysis also uses a smooth inlet velocity profile. The calculated variation of volume fraction with flow ratios, fuel radius, and fluid density is shown to be in general agreement with previous data. Author

N70-31873*# Aerojet-General Corp., Azusa, Calif. Mechanical Systems Operations.

DESIGN AND DEVELOPMENT OF A SNAP-8 MERCURY PUMP MOTOR ASSEMBLY

J. R. Pope, C. S. Mah, and C. L. Foss Nov. 1969 50 p refs
(Contract NAS5-417)
(NASA-CR-72664; AEROJET-3865) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 18N

This report describes the design and development of a mercury pump and motor for use in the SNAP-8 Electrical Generating System while in a space environment. The pump, a combination jet-centrifugal type, is driven by a motor with oil-lubricated ball bearings. A dynamic, shaft seal-to-space is used to separate the mercury and the lubricant oil. A total of 6 units have been built and operated for an accumulated testing time of 22,213 hours; the longest test time on one unit was 12,227 hours. The pump was considered to be successful and exceeded the specification requirements for a 10,000 hour life. The only complications encountered were in the seal-to-space. Author

N70-31886*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POST-SHUTDOWN TEMPERATURE OF A BURIED REACTOR SYSTEM FOR A LUNAR BASED POWER PLANT

C. J. Wenzler and P. H. Lustig [1970] 26 p refs
(NASA-TM-X-52830) Avail: CFSTI CSCL 18E

A study of the afterheat from delayed neutron fissions, fission product decay, and induced radioactivity was made on a lithium cooled fast reactor system. The main sources of energy contributing to shutdown power are fission product decay and neutron induced activity of the tantalum in the reactor core and pressure vessel. The delayed neutron contribution to shutdown power is negligible within 500 seconds after shutdown. The rate of temperature increase during the first several minutes after shutdown with no auxiliary cooling is low, making it unnecessary to establish the peak auxiliary cooling rate immediately after reactor shutdown. In all cases of reactor operating time, auxiliary cooling is required to prevent the system from overheating. Auxiliary cooling can be terminated when shutdown power has decayed enough so that passive cooling can reject heat at a high enough rate to prevent overheating. Auxiliary heating will probably be required to prevent the coolant from solidifying if the reactor has operated for only a short time (on the order of one day). Author

N70-31897*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL EVALUATION OF TANTALUM/STAINLESS STEEL MERCURY BOILERS FOR THE SNAP 8 PROGRAM

Edward R. Furman, Robert D. Brooks (GE, Cincinnati, Ohio), and R. W. Harrison (GE, Cincinnati, Ohio) 1970 13 p refs Proposed for presentation at AIAA 5th Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21–24 Sep. 1970
(NASA-TM-X-52841) Avail: CFSTI CSCL 18N

The greatest difficulties encountered in the utilization of mercury as the working fluid in a Rankine system have been the repeatability of the degree of fluid wetting of the heat transfer surfaces and the corrosion of the containment material by the working fluid. A mercury boiler has been designed for the SNAP-8 system which utilizes tantalum for mercury containment. Four boilers of this design have been tested over a wide range of operating conditions which encompasses the SNAP-8 system requirements. The performance of the boilers and the post-test physical and metallurgical examinations of two of the designs are discussed. The design modifications and performance of a third boiler are briefly reviewed. Author

N70-31949# Battelle-Northwest, Richland, Wash.
NUCLEAR SAFETY Quarterly Report, Nov. 1969 – Jan. 1970
Mar. 1970 148 p refs
(Contract AT(45-1)-1830)
(BNWL-1315-1) Avail: CFSTI

Two large scale runs to evaluate the performance of recirculating air cleaning systems were completed in the CSE containment vessel during the quarter. The initial containment atmosphere comprised saturated steam and air at 250 F and about 48 psia. In both runs the air cleaning system included a high efficiency particle filter and three charcoal filters. One run included a heat exchanger and demister at the inlet of the air cleaning system. In the other run, these two components were omitted to evaluate the effect of larger moisture loadings on the filter components. In both runs, concentrations of airborne iodine forms and particles decreased in close agreement with predictions made assuming a well mixed atmosphere and 100% filtering efficiency. Elemental iodine was removed somewhat more rapidly than predicted with these assumptions, and this behavior is attributed to the increased removal by natural processes because of higher gas phase velocities when the air cleaning system operates. Author

N70-31974# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Lab. Operazioni Calde.
HOT CELLS FOR POST IRRADIATION EXAMINATION OF LOW ACTIVITY SAMPLES [CELLE CALDE PER ESAMI POST IRRAGGIAMENTO SU CAMPIONI A BASSA ATTIVITA]
C. Cesarano, M. Lauro, C. Lepscky, G. Pygnetti, and S. Sartori [1970] 41 p ref In ITALIAN
(RT/ING(69)20) Avail: CFSTI

The hot laboratory of Casaccia is equipped with high activity hot cells for post irradiation examination of fuel elements. In addition, lead brick cells for special examination have been built. These cells are described. Special examinations are for the ones with low activity samples, and requiring delicate or expansive experimental equipment to be totally or partially shielded. Therefore, the hot cells have been designed to suit the equipment while in the high activity cells the equipment is designed to suit the dimensions of the available space and facilities of the hot cells. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-30625# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
PULSE RADIOLYSIS: CONVERSION TABLES. PERCENT ABSORPTION TO OPTICAL DENSITY, LOGIO (OPTICAL DENSITY) AND RECIPROCAL OPTICAL DENSITY
P. J. Richards Mar. 1970 65 p
(AECL-3567) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.50

Conversion tables were compiled relating percent of light absorption to the required parameters opitcal density, log 10(optical density), and reciprocal optical density. Author

N70-30629# Sandia Corp., Albuquerque, N.Mex.
APPROXIMATE ANALYTIC EXPRESSIONS FOR THE ATTENUATION OF A TRIANGULAR PRESSURE PULSE WITH DISTANCE
L. D. Bertholf and M. L. Oliver Feb.1970 65 p refs Sponsored by AEC
(SC-RR-69-596) Avail: CFSTI

Based on a purely mechanical theory for shock wave propagation, three different approximate analytic expressions are derived to describe the attenuation of triangular pulse with distance. These expressions represent various degrees of approximation and are compared to a WONDY solution for aluminum. This analysis is valuable for estimating attenuation and adding insight to the attenuation process. The results of a brief attenuation study are presented. Author

N70-30640# Brown Univ., Providence, R.I. Dept. of Physics.
DIRECT GENERATION OF SOUND IN METALS AND ACOUSTIC NUCLEAR SPIN RESONANCE
J. J. Quinn 1970 14 p refs Sponsored in part by ARPA and NSF
(AD-702793) Avail: CFSTI CSCL 20/1

The basic equations describing the direct electromagnetic generation of sound in a metal are studied. The boundary conditions are taken to be those applicable for specular reflection of the conduction electrons at the surface. The resonances of the surface impedance associated with setting up a standing acoustic wave in a metallic plate are evaluated, and the contribution of direct acoustic generation and subsequent acoustic NMR to the nuclear magnetic resonance signal is investigated. Author (TAB)

N70-30668# Illinois Univ., Urbana. Dept. of Computer Science.
STUDIES IN IMAGE PROCESSING: A SYSTEMS VIEWPOINT
Jacob L. Woolson and Charles H. Heider 12 Feb. 1970 67 p refs
(COO-1018-1198; Rept-825) Avail: CFSTI

The first part of this analysis, literature search, develops the outline of the image processing modules, and presented specific examples of modules used in the first four major categories of pattern recognition processing: optical filtering, image encoding and digitization, image enhancement and pattern articulation. The second part of the paper presents examples for the final two major categories of pattern recognition processing: diagraph representation and cognition. It is recognized that the treatment of the image processing modules presented here is still very preliminary and in some instances totally missing. Author

N70-30821*# Benson (Robert W.) and Associates, Inc., Nashville, Tenn.
A STUDY OF ACOUSTIC IMPEDANCE MEASUREMENTS OF MATERIALS WITH AIR FLOW Final Report
30 Jan. 1970 36 p
(Contract NAS1-8695)
(NASA-CR-66937; L17-9573) Avail: CFSTI CSCL 20A

Sound absorbing materials used within jet engine nacelles for the purpose of reducing compressor noise are subjected to high intensity sound waves at all angles of incidence and in the presence of air flow. In order to economically select suitable materials for this application it is desirable to perform laboratory measurements of the impedance characteristics of the materials over the same range of conditions. Methods were developed which allow for the measurement of acoustical impedance as a function of the angle of incidence and with the presence of air flow. The system uses a large plane wave high intensity sound source, a propagation section with variable angle of incidence, and two fixed pressure microphones. Author

N70-30849*# Pennsylvania State Univ., University Park.
SOUND ABSORPTION IN ACOUSTICALLY TREATED DUCTS IN THE PRESENCE OF OBLIQUE WAVES
Peter A. Marino, Jr. (M.S. Thesis) Jun. 1970 136 p refs
(Grant NGR-39-009-121)
(NASA-CR-66968) Avail: CFSTI CSCL 20A

A program aimed at providing a preliminary engineering study of the design and performance of acoustically absorptive duct linings for jet engine inlets is reported. A modified traveling wave duct was constructed capable of accepting, as a lining, the various absorptive configurations to be tested as possible attenuators of the higher duct modes. These configurations were then tested for their insertion loss qualities when the wave modes were propagated down the duct. Normal absorption coefficient measurements were made on fourteen different sample configurations. The samples were placed at the end of the duct and subjected to normal incidence waves having varied frequencies from 400 to 2000 Hz. Findings include the following: (1) Of the materials tested, the most porous had the highest value of absorption at every frequency and this value could be increased or decreased by varying the thickness of the material samples. (2) The thicker samples offered more air pockets and resistive surfaces to dissipate the sound and consequently offer more absorption. (3) All of the porous samples, when tested with a solid backing, absorbed the incident sound below their maximum level. D.L.G.

N70-31148# National Bureau of Standards, Washington, D.C. Electricity Div.
STANDARD TESTS FOR ELECTRICAL PROPERTIES
Arnold H. Scott *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 427 - 430 refs (See N70-31104 16-09)
Avail: SOD $4.50

The description and use of test methods for plastics, and the significance of the tests are discussed. The tests include volume and surface resistivity, permittivity and dissipation factor, dielectric strength, and arc resistance. N.E.N.

N70-31151# National Bureau of Standards, Washington, D.C. Electricity Div.
THE CALIBRATION OF PERMANENT MAGNETIC STANDARDS
Irvin L. Cooter *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 477 - 484 Presented at 20th Ann. ISA Conf. and Exhibit, Los Angeles, 4-7 Oct. 1969 Submitted for publication
Instr. Soc. of Am. Preprint no. 14. 1-3-65
Avail: SOD $4.50

The procedure and apparatus used in the calibration of reference magnets are described. The calibration procedure is based on the accurate measurement of the flux density in the gap of an electromagnet or at the center of a set of Helmholtz coils. This accurately known flux density is compared with the flux density in the gap of the permanent magnet standard through the use of a suitable transfer instrument. These instruments are based on the Hall effect, rotating coil, and search coil or torque devices. Author

N70-31286 Paris Univ. (France). Lab. de Chimie Physique.
X-RAY FREQUENCY SELECTOR FOR THE SYNCHROTRON RADIATION: STUDY OF THE SPECULAR REFLECTION BETWEEN 6 AND 14 ANGSTROM [SELECTEUR DE FREQUENCES X POUR LE RAYONNEMENT SYCHROTRON: ETUDE DE LA REFLEXION SPECULAIRE ENTRE 6 ET 14 ANGSTROM]
R. Barchewitz, C. Bonnelle, and M. Montel 1968 12 p refs In FRENCH Presented at the 5th Intern. Congr. on X-ray Optics and Microanalysis, Tuebingen, West Ger., Sep. 1968 Submitted for publication
Avail: Issuing Activity

A total reflection device was designed to eliminate frequencies lower than the one required in the spectra of synchrotron radiation. It does not reduce the synchrotron radiation intensity by more than 50% and is still stronger than X-ray tube radiation. Results of a study of specular reflection in the range 6 and 14 A using different glasses and metallic coatings are discussed. ESRO

N70-31305# Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Sciences.
A CROSS-SPECTRAL MODEL RELATING FLUCTUATIONS IN UNDERWATER ACOUSTIC PHASE TO ENVIRONMENTAL PARAMETERS
Kamal Yacoub Mar. 1970 50 p refs
(Contract Nonr-840(16))
(AD-703684; ML-70025) Avail: CFSTI CSCL 20/1

The relationships between daily fluctuations in the phase of the complex propagation loss across the Straits of Florida and daily fluctuations in environmental parameters are quantitatively examined by means of cross-spectral analysis. A multi-input analytic model is suggested defined by its frequency response matrix, with deep and shallow water temperatures, tide-height, and wind components serving as inputs while two phases of the received signal measured at hydrophones 3 and 43 nautical miles, from the source serve as outputs. Analyses of the model are based on 3 months of continuous measurements of input and output data. The frequency response matrix is evaluated and residual spectra and multiple coherence functions are calculated. It is observed that variations in the deep water temperature and tide-height have the strongest coherence with the daily phase fluctuations. Author (TAB)

N70-31308# Pennsylvania State Univ., University Park. Dept. of Physics.
STIMULATED AND SPONTANEOUS LIGHT SCATTERING Technical Report, 1 Mar. 1968 - 28 Feb. 1970
D. H. Rank 28 Feb. 1970 136 p refs Submitted for publication
(Contract N00014-67-A-0385-0008)
(AD-702758) Avail: CFSTI CSCL 20/6

The report contains a series of six papers on high resolution grating spectroscopy and interferometric measurements of light scattering. Close-in satellite line due to a high quality diffraction grating are investigated. It is shown that it is necessary to consider these ghost lines even with the best available gratings. Two paper deal with spontaneous scattering. In one the speed of sound in a number of liquids is determined as a function of temperature and relaxation affects are studied. In the other the Krishman effect index of refraction measurements and sound speeds measured through the glass-rubber transition temperature in methacrylate plastics indicate that strains are only partially removed by annealing. The speed of sound in CO2, CH4, N2 and SF6 are measured as a function of density. It is shown that with careful control of transverse mode structure, stimulated measurements can yield precise and accurate results. Some disagreement is found between speeds from experimentally and those extrapolated from ultra sonic results. Two papers giving a review of stimulated scattering results are included. Author (TAB)

N70-31517# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ULTRASONIC REFLECTION AND TRANSMISSION FACTORS FOR MATERIALS WITH ATTENUATION

F. L. Becker, C. E. Fitch, and R. L. Richardson Mar. 1970 92 p refs

(Contract AT(45-1)-1830)

(BNWL-1283) Avail: CFSTI

A model for the propagation of ultrasonic plane waves which includes the effects of attenuation has been developed. This report represents our viscoelastic ultrasonic wave model and its solutions. The effects of attenuation on reflection and transmission coefficients have been investigated using this model. It was found that in most cases attenuation can be ignored for incident angles less than approximately two degrees below the longitudinal critical angle. For larger angles especially, the longitudinal, shear and Rayleigh critical angles material attenuation is an important factor. Reflection and transmission coefficients for aluminum, copper, iron, iron 30% nickel, and nickel plates immersed in water were calculated and are listed. These calculations were accomplished for material grain sizes of 0.01, 0.005, and 0.001 in. at frequencies of 1, 10 and 20 MHz. NSA

N70-31660*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

SLUSH HYDROGEN FLUID CHARACTERIZATION AND INSTRUMENTATION

C. F. Sindt and P. R. Ludtke 6 Nov. 1969 72 p refs

(NASA Order H-2149A)

(NASA-CR-110526; NBS-9745) Avail: CFSTI CSCL 20M

Areas of slush hydrogen fluid characterization and instrumentation covered are transfer, storage, and density measurement. A technique of increasing solid content of slush hydrogen in a storage vessel was devised and proven. Retaining solids with a 30-mesh screen while drawing off triple-point liquid was the method used. Two types of nuclear radiation attenuation densitometers were used to determine the density of the upgraded slush. Two beta ray point sensors which were submerged in the fluid were tested. Data from these sensors are compared with data from an externally mounted gamma ray densitometer. Evaluation was made of two types of mixers in the upgraded slush. Two propeller mixers were tested. A single propeller either did not stir high solid fraction slush or did not give adequate mixing in the 234 cm (92 in.) deep vessel. Three equally spaced propellers on a single shaft provided good mixing. A ducted propeller design with suitably located discharge ports in the duct gave good homogeneous mixing in slush of solid fractions in excess of 0.5. Temperature stratification in the liquid hydrogen over settled solids was measured in the upgrading vessel and the data are presented. Author

N70-31689# California Inst. of Tech., Pasadena.

HOLOGRAPHIC DIELECTRIC GRATING: THEORY AND PRACTICE

Milton Chang and Nicholas George Aug. 1969 30 p refs

(Grant AF-AFOSR-1492-68)

(AD-704154; AFOSR-70-0932TR) Avail: CFSTI CSCL 20/6

Lossy dielectric gratings have been analyzed using a Raman-Nath formalism modified to incorporate losses. Four second order coupled-wave equations are retained for computation of the zero; first-, and second order diffracted beams for a multitude of practical cases. Significant differences are found in comparison to computations in which only two coupled waves are retained. The entire range of losses and thicknesses encountered for holograms in film emulsions has been studied using this unified approach. Graphs have been prepared to show the efficiency, power diffracted in the first-order relative to the total incident power, versus the index modulation for a wide range of thicknesses and losses. At a given thickness, optimum efficiency requires a specific exposure. The efficiency for an optimum exposure is plotted versus the loss factor with thickness as a parameter. New experimental data are presented for bleached gratings in which several diffracted orders are measured and compared to our theory for a wide range of index modulation and loss factors. Author (TAB)

N70-31690# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.

NONLINEAR REFRACTIVE INDICES OF C-52-CCl4 MIXTURES

Robert Hellwarth and Nicholas George Sep. 1969 19 p refs Presented at Non-Linear Optics Conf., Belfast, 12 Sep. 1969

(AD-704156; AFOSR-70-0994TR) Avail: CFSTI CSCL 20/6

The two independent fast nonlinear refractive indices for liquid mixtures of CS2 and CCl4 have been determined to within 5% relatively and 8% absolutely over their range of more than a decade. These indices describe nonlinear propagation of optical pulses of arbitrary polarization, which are of too short duration to be affected by electrostriction. Reported are measurements of the static Kerr constants of these mixtures having relative accuracy better than one percent. These results are combined with recent data on Rayleigh wing depolarization ratios for the same mixtures to deduce the desired nonlinear indices with the aid of molecular theory. The nonlinear refractive index for linearly polarized light is shown to be two-thirds (plus or minus 5%) of the index difference measured by the Kerr effect, at least for molar concentrations of CS2 greater than 10%. The measured relative values of the mixture Kerr constants are predicted to within experimental error if one simply replaces the Lorentz local field factors in the classical theory by their 0.6 powers. Author (TAB)

N70-31791# Naval Ordnance Lab., White Oak, Md.

SHALLOW-WATER REVISITED: FURTHER ACOUSTIC OBSERVATIONS AT A SITE OFF THE COAST OF FLORIDA

Robert J. Urick 15 Jan. 1970 27 p refs

(AD-703609; NOLTR-69-234) Avail: CFSTI CSCL 17/1

Acoustic measurements were made at a location off the West Coast of Florida where transmission data had been obtained six months earlier. In the newer measurements, a negative temperature gradient replaced the mixed layer extending over most of the 200-foot water column in the earlier tests. The difference was found to have a profound effect on the transmission of the higher frequencies trapped in the water layer, but to have little or no effect on the lower frequencies governed by the characteristics of the bottom. The effect was greater for a shallow receiver than a deep one. The two tests provide the first known quantitative data on acoustic transmission at the same shallow water location under contrasting conditions in the water column. Author (TAB)

N70-31796# Naval Weapons Center, China Lake, Calif. Research Dept.

ANTIFERROMAGNETIC RESONANCE MEASUREMENTS IN EUROPIUM TELLURIDE

James W. Battles 27 Feb. 1970 95 p refs

(AD-703622; NWC-TP-4851) Avail: CFSTI CSCL 20/3

The antiferromagnetic resonance in europium telluride was measured on single crystals as a function of crystallographic direction. The measurements were made at the frequencies 9, 18, and 24 GHz at 1.17K. The resonance experiments have shown that the order in EuTe is of the easy plane type with a large anisotropy energy causing the <111> direction to be a hard direction and the (111) plane to be an easy plane. The resonance equations for a fcc type II antiferromagnet are derived from the free energy equation. The line width as a function of temperature has also been measured in both the paramagnetic and antiferromagnetic regions. The results are similar to those obtained on other antiferromagnets

showing a strong maximum in the vicinity of the ordering temperature. Author (TAB)

N70-31843# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
STUDY OF HIGH EXPLOSIVES BY OPTICAL THERMAL ANALYSIS
Billy Don Faubion Sep. 1969 43 p refs Prepared for AEC
(Contract DA-11-173-AMC-487(A))
(MHSMP-12) Avail: CFSTI

An automatic thermomicroscopy method was used to study the polymorphic transitions of several high explosives. The applications of the method were illustrated with three compounds whose polymorphic states were previously characterized, ammonium nitrate, 2,4,6-trinitroresorcinol and pentaerythritol tetranitrate. The temperatures for the polymorphic transitions of dipentaerythritol hexanitrate (diPEHN), tripentaerythritol octanitrate (triPEON) and tetrapentaerythritol decanitrate (tetraPEDN) were measured. DiPEHN had two polymorphic forms with melting points of 75 C and 72.5 C. Four polymorphic forms were found for triPEON with melting points of 83 C, 76–77 C, 68–70 C and 64–65 C. Only two polymorphs of tetraPEDN were found with melting points of 90 C and 80 C. The results obtained on hexanitroazeobenzene (HNAB) indicate that the polymorphic transitions are reversible. A sample crystallized from melt had two polymorphic transitions at 151 C and 187 C. Author

N70-31911*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LARGE TELESCOPE EXPERIMENT PROGRAM (LTEP). VOLUME 2: TECHNICAL PROPOSAL Final Technical Report
5 Jan. 1970 358 p refs Prepared in cooperation with the Perkin–Elmer Corp., Norwalk, Conn.
(Contract NAS8-21497)
(NASA-CR-102756; LSMC-A958175) Avail: CFSTI CSCL 17H

The overall approach, reference orbit and mission requirements of the program are given. Data which is provided for the spacecraft system description contains these elements: overall configuration, launch, ascent and erection, program peculiar elements, and spacecraft subsystems. Various analyses performed in support of the spacecraft system are delineated. These include the launch vehicle and performance, thermal, and astronaut participation aspects of the study. Author

N70-31987# Atomic Energy Commission, Washington, D.C.
WAVE EQUATIONS APPROXIMATING THE PRECISE SOLUTIONS FOR NONLINEAR ELECTRODYNAMICS AND OPTICS, PART 2 [TEORIYA VOIN, BLIZKIKH K TOCHNYM RESHENIYAM NELINEINOI ELEKTRODINAMIKI I OPTIKI, 2]
V. M. Silin et al [1969] 33 p refs Transl. into ENGLISH from Russian report
(AEC-TR-7135-Pt-2; NP-17915-Pt-2) Avail: CFSTI

Asymptotic solutions of nonlinear field equations were obtained for singular values of wave vectors in the case in which one-mode solutions by amplitude steps were impossible. Moreover, the above demanded solutions of nonlinear one-dimensional equations for the fundamental mode, and in one case, the use of several harmonic modes. Two-dimensional solutions were constructed for approximating the exact nonlinear periodic one-dimensional waves and the possible wave vector values were found. Author (NSA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-30616# California Univ., Berkley. Lawrence Radiation Lab.
ASPECTS OF BARYON RESONANCES
Robert D. Tripp 1 Oct. 1969 81 p refs Presented at the 3rd Topical Conf. on Particle Phys., Honolulu, Hawaii
(Contract W-7405-eng-48)
(UCRL-19361; CONF-690827-1) Avail: CFSTI

The discussion of baryon resonances covers some concepts for the analysis of these resonances in production experiments, the multiplet structure decay rates, and signs of the reaction amplitudes of better-established resonances in SU(3) symmetry. Emphasis is placed on the elaboration of the 1/2(−) octet and singlet. Some recent results concerning Y^* resonances are also examined. The N^* and xi^* are discussed relative to their SU(3) classifications. Lastly the existence of the exotic baryon resonances are considered. NSA

N70-30617# Iowa State Univ. of Science and Technology, Ames.
PHENOMENOLOGICAL REGGE TRAJECTORIES IN DIRECT CHANNEL PION-PROTON ELASTIC SCATTERING
Edward Thomas Stoessel (Ph.D. Thesis) Nov. 1969 77 p refs
(Contract W-7405-eng-82)
(IS-T-355) Avail: CFSTI

An investigation of the possibility of using a direct channel Regge pole theory to describe low energy scattering data is described. The model amplitude which is derived is similar to the modified Regge representation proposed by Mukherjee but is different in two important respects: The Mukherjee representation does not apply to a process in which the particles may have spin whereas the one presented here applies to the helicity amplitudes of the general Jacob–Wick expansion. The Reggeization of a signatured helicity amplitude does not lead to a signatured model except in the spinless case. It is shown how to ensure the preservation of signature by including an appropriate part of the background integral. A preliminary numerical investigation of the pion-proton elastic scattering process is discussed and it is found that there is some likelihood of the success of a more extensive numerical study. Author (NSA)

N70-30618# Kentucky Univ., Lexington. Dept. of Physics and Astronomy.
CHARGED PARTICLE INTERACTIONS WITH NOBLE GASES Annual Progress Report, 15 Apr. 1969–14 Apr. 1970
G. S. Hurst Jan. 1970 41 p refs
(Contract AT(40-1)-3650
(ORO-3650-3) Avail: CFSTI

Progress is reported briefly on proton excitation of argon, helium, and xenon. Plans for lifetime measurements using the 250-keV pulsed electron accelerator and for oscillator strength measurements are noted. A paper to be submitted for publication on collisional destruction of the 6 P-3 sub 1 state of Hg is included. NSA

N70-30619# Battis Atomic Power Lab., Pittsburgh, Pa.
SPAN-4: A POINT-KERNEL COMPUTER PROGRAM FOR SHIELDING
O. J. Wallace Dec. 1969 308 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-809) Avail: CFSTI

SPAN-4 is a shield-evaluation program which may be used to calculate fast-neutron dose rate, thermal-neutron flux, and gamma-ray flux, dose, rate, and energy-absorption rate in rectangular, cylindrical, and spherical geometries by integration of appropriate exponential kernels over a source distribution. In SPAN-4, which is a substantial extension of SPAN-3, provision is made for increased flexibility in defining the shield configuration. A basic geometry (rectangular, cylindrical, or spherical) is defined for the shield configuration, and is used to specify the meshlines in the first-level shield unit. The first-level shield usually encompasses all

of the shields and components which are to be represented in the problem. After the first-level shield unit has been specified, new shield units may be defined (using a different geometry than the first-level shield if desired), and portions of these new shield units may be embedded between the meshlines of the first-level shield unit. Author (NSA)

N70-30638# Boston Univ., Mass.
THE STUDY OF NITROGEN (A TRIPLET SIGMA) GENERATED BY 1849 ANGSTROM MERCURY PHOTOSENSITIZATION Final Technical Report
Norman N. Lichtin and Morton Z. Hoffman 2 Mar. 1970 11 p refs
(Contract AF-AFOSR-765-67)
(AD-702816; AFOSR-70-0759TR) Avail: CFSTI CSCL 7/4

The possibility that energy transfer from Hg(singlet P(1)) produces N2(A triplet Sigma(u)(+)) was suggested by emission of 2537 A radiation when mercury vapor was irradiated by 1849 A mercury resonance radiation. However, the same scintillation phenomenon is observed with many quenchers including rare gases. The efficiency of quenching of 1849 A mercury fluorescence does not depend on the chemical nature of the quenching gas but only on its mass. Satellite fluorescence bands near 1849 A are easily induced by various quenchers. The absence of observable slow decay of 2537 A scintillation when 1849 A irradiation of mercury vapor and N2 is abruptly terminated suggests that N2(A triplet Sigma(u)(+)) is not involved in the scintillation process. All data can be accommodated by collision induced HG(singlet P(1)) to Hg(triplet P(1)) intersystem crossing but this mechanism has not yet been confirmed. Author (TAB)

N70-30648# Syracuse Univ., N.Y. Dept. of Physics.
LOW ENERGY PROTON-PROTON SCATTERING WITH A SEPARABLE POTENTIAL, AND APPLICATIONS TO FINAL STATE INTERACTIONS INVOLVING TWO PROTONS
C. W. Gardinar Sep. 1969 37 p. refs Sponsored in part by AEC
(SU-1206-214; NYO-3399-214) Avail: CFSTI

It is shown that a separable potential may be added to a Coulomb potential to give an exactly soluble equation. This equation is solved using some approximations which are necessary to get simple analytic formulas, and derive effective range formulas for the p-p system. Fits are compared to the data for p-p, n-n, and n-p (singlet) scattering, and it is concluded that the treatment is consistent with charge symmetry between p-p and n-n reactions, but that the n-p (singlet) has significantly different behavior. Finally, the wavefunctions derived are used to give a treatment of p-p final state interactions, which is compared with n-n and n-p final state interactions in the impulse approximation. The treatment differs from others in that all the sets of two nucleon wavefunctions involved are complete and orthogonal, since they are all solutions of Schrodinger equations (the approximation in the p-p calculations modifying the separable potential, so that the wavefunctions are still solutions of a Schrodinger equation). Author (NSA)

N70-30662# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECT OF WATER VAPOR ON THE VOLATILITY OF FISSION PRODUCT OXIDES
Donald A. Furey and Ernest W. Bloore Feb. 1970 16 p refs
(AD-702884; BRL-MR-2022) Avail: CFSTI CSCL 18/8

Volatilities of the oxides of antimony,tin, and ruthenium in the presence of water vapor were studied by the transpiration method. The volatility of Sb2O3 was determined at 600C, but no volatile hydroxide species was detected at this temperature. No volatile hydroxide species were detected for Sb2O4, RuO2, or SnO2 at temperatures up to 930C. Author (TAB)

N70-30663# Ballistic Research Labs., Aberdeen Proving Ground, Md.
USE OF WOO AND WHEALTON'S TRANSPORT MODEL FOR CONVERTING CHARGED SPECIES IN DRIFT TUBES
George E. Keller, Mary R. Sullivan, and Mark D. Kregel Feb. 1970 15 p refs
(AD-702883; BRL-MR-2021) Avail: CFSTI CSCL 7/4

One of the laboratory tools that is particularly well suited for studying ion-molecule reactions is the drift tube. Woo and Whealton have recently published a versatile analytical transport model for two converting charged species in a drift tube. Unfortunately, the original publication contained several errors, and in addition, the mathematical expressions contained in the solution of their model are quite complicated, with the result that a direct approach to the programming of their solution is unnecessarily difficult. The report gathers in one location the corrected model, the information necessary for its use, our mathematical modifications for computational simplification, and the solution of their model recast in terms of the mathematical modifications. Author (TAB)

N70-30694# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF THE BRANCHING RATIO K YIELDS 2 PION/K YIELDS 3 PION
William P. Oliver (Ph.D. Thesis) Nov. 1969 57 p refs
(Contract W-7405-eng-48)
(UCRL-19397) Avail: CFSTI

The rate of the decay K(zero) yields 2 pion(zero) was measured relative to that of K(zero) yields 3 pion(zero) using a monoenergetic K(zero) beam and a nearly 4 pion solid-angle detection system of lead-plate spark chambers and shower counters. The analysis of the fraction (40%) of the data at the Lawrence Radiation Laboratory gives for the branching ratio 0.0100 + or - 0.0018 (statistical) + or - 0.0009 (systematic). Author (NSA)

N70-30757*# Techtran Corp., Glen Burnie, Md.
ELASTIC PION(+)-PROTON SCATTERING AT A PION(+) ENERGY AT 2.06 GeV
S. P. Kruchinin et al *In its* Elementary Particles and Cosmic Rays May 1970 p 30-35 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

This article investigates elastic pion(+)-p-p-scattering at a pion(+)-meson energy of 2.06 GeV. The paper compares results of previous papers which measured the differential cross sections of elastic pion(+)-p-scattering at pulses of 2.0 and 2.5 GeV/c over a range of angles theta < 20°. This paper presents the differential cross section of elastic scattering of pion(+)-mesons with an energy of 2.06 GeV in protons over the entire range of angles. The deduction method was used to obtain the cross section in the range of angle theta < 20° Author

N70-30758*# Techtran Corp., Glen Burnie, Md.
THE MASS SPECTRUM OF SYSTEMS OF STRANGE PARTICLES GENERATED BY THE INTERACTION OF PIONS WITH LIGHT NUCLEI
V. S. Demidov et al *In its* Elementary Particles and Cosmic Rays May 1970 p 36-43 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

The study of the mass spectrum of systems of strange particles generated by the interaction of pion-mesons with light nuclei is presented. The mass spectrum of a system of two neutral strange particles, kaon(O)-lambda hyperon(O) and kaon(O)-antikaon(O), produced by collisions of positive proton-mesons with light nuclei was investigated. The experiment used a 105 cm bubble chamber filled with a mixture of Freon-12 and Freon-13. The chamber was irradiated by a beam of pion-mesons with an average pulse of 3.86 + or - 0.04 GeV/c. Results are inconclusive because of insufficient statistics. Author

N70-30759*# Techtran Corp., Glen Burnie, Md.
THE THEORY OF COMPLEX MOMENTS AND RESONANCE NUCLEAR REACTIONS
V. V. Grushin et al *In its* Elementary Particles and Cosmic Rays May 1970 p 44–64 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

The SAU (inherent asymmetry of nuclear level) effects which occur during resonance interaction of spinless particles as well as particles having spins of 0 and 1/2, within the limits of the Khuri concept which has many advantages when compared with the Regge concept is investigated. The article presents a step-by-step calculation of Coulomb interaction which must be taken into consideration during resonance scattering of charged particles. The developed theory is then applied to resonance scattering of alpha-particles and protons in a C-12 nucleus. The path of the Regge pole trajectories was established when compared with the experiment. It is shown that the Khuri method leads to results hardly differing in the case of the scattering of alpha-particles in a C-12 nucleus from the results of the papers cited. Author

N70-30760*# Techtran Corp., Glen Burnie, Md.
A UNIVERSAL METHOD OF PROCESSING THE TRACKS OF ARBITRARY CURVATURE ON BUBBLE CHAMBER TRACKS
K. N. Mukhin et al *In its* Elementary Particles and Cosmic Rays May 1970 p 65–76 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

A universal method of calculating the tracks of charged particles in bubble chambers is presented. The data base for such calculations are the coordinates of a number of points of the track being studied, measured on special devices. The track is approximated by the segment of a helicoid, but such approximation is completely valid only when there are no energy losses by the charged particle. The problem is often further simplified by projecting the track onto a plane normal to the vector of magnetic field intensity, such projection being approximated by a Probala. This approximation is sufficiently accurate only when considering the arcs of a circle small in comparison with the radius. The method proposed is suitable to determine the parameters of a track of variable and arbitrarily large curvature over the entire energy range and length measured. Author

N70-30761*# Techtran Corp., Glen Burnie, Md.
A METHOD OF REGISTERING THE ENERGY OF CHARGED PARTICLES WITH A PROPORTIONAL LIGHT COUNTER
V. G. Varlamov et al *In its* Elementary Particles and Cosmic Rays May 1970 p 77–80 ref (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

A proportional light counter used to record the energy of charged particles is described. The gas scintillation counter utilizes a Po-210 alpha-source and the inside of the counter is filled with an inert gas mixture. The energy of the charged particles is determined by the magnitude of scintillation caused by the ionization losses of these particles. Author

N70-30762*# Techtran Corp., Glen Burnie, Md.
MODELING PROCESSES WITH GENERATION OF NEUTRAL PARTICLES IN NON-HYDROGEN BUBBLE CHAMBERS
K. N. Mukhin et al *In its* Elementary Particles and Cosmic Rays May 1970 p 81–88 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

A method of identifying particles and reactions in a propane bubble chamber is selected. Reaction processes with generation of two charged and several neutral particles, the decays of which generate a typical V-branch in the chamber are modeled by the Monte Carlo method. The configuration of the chamber, the composition and momentum spread of the initial beam, fermi neucleon motion, and also experimental measurement errors are considered. Moreover, pseudo-reaction is analyzed kinematically, i.e., its physical parameters are determined, and are then compared with true values obtained from modeling this reaction, and the possibility of identifying it is thus verified. Calculations were made for a 10-liter propane bubble chamber exposed to a beam of positively charged particles with a pulse of 2.25 GeV/c. Author

N70-30763*# Techtran Corp., Glen Burnie, Md.
GENERATION OF HIGH-ENERGY MUONS DURING INTERACTION OF COSMIC RAY NUCLEI OF AIR
Yu. D. Kotov *In its* Elementary Particles and Cosmic Rays May 1970 p 89–93 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

The pattern of muon generation during the decay of pions which occurs as a result of the interaction of cosmic ray nuclei with those of air is investigated. The interaction of high-energy protons with nuclei of air during which pions are generated due to the decay of an isobar occurring during the interaction is considered. Author

N70-30764*# Techtran Corp., Glen Burnie, Md.
COSMIC GAMMA-RADIATION
A. M. Galper et al *In its* Elementary Particles and Cosmic Rays May 1970 p 94–111 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

The measurement of cosmic X-ray and gamma-ray photon fluxes originating in the galaxy and in the metagalaxy. Experiments carried out on balloons and satellites and also the equipment used to conduct the experiments are described. A survey is presented which summarizes the results of recent experiments and discusses the methodology and techniques of the experiments. Author

N70-30765*# Techtran Corp., Glen Burnie, Md.
ABSORPTION OF PIONS BY COMPLEX NUCLEI
V. G. Kirillov-Ugryumov et al *In its* Elementary Particles and Cosmic Rays May 1970 p 112–120 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

This paper surveys experiments on the study of pion-meson absorption by complex nuclei. Absorption of pion-mesons by light emulsion nuclei of C, N and O and by heavy nuclei of Ag and Br is investigated. This article describes experiments conducted in an emulsion chamber consisting of 90 layers of a 10 × 10 cm BR-400 nuclear emulsion exposed to a beam of pion(+)-mesons. The distribution of stars according to the number of beams, the output and mass spectrum of secondary charged particles with an energy greater than 14 MeV in two-prong stars and the kinematics of two-prong stars are described. The authors conclude that there is a significant amount of pion(+)-meson capture by pairs of nucleons in low-energy states. Author

N70-30766*# Techtran Corp., Glen Burnie, Md.
STUDY OF THE PHYSICAL AND CHEMICAL PROPERTIES OF THE SURFACES OF SOLIDS USING NUCLEAR GAMMA-RESONANCE (THE MOSSBAUER EFFECT)
I. P. Suzdalev *In its* Elementary Particles and Cosmic Rays May 1970 p 121–143 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

Research in the field of surface effects as displayed by non-transfer nuclear gamma-resonance (the Mossbauer effect) in applications to atoms located on the surfaces of solids is reviewed. This paper considers the two groups of the parameters of NGR spectra. The first group is characterized by atomic oscillation on the surface, by the forces linking the atom to the surface and by diffusion along the surface. The second group characterizes the

electron state of an atom on the surface, the nature of its environment, and the presence of electrical and magnetic interaction of the nucleus with its electron shell. Author

N70-30829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMPLIFIED MODEL FOR POSITRONIUM-HELIUM SCATTERING
Richard J. Drachman and S. K. Houston Jun. 1970 21 p refs Submitted for publication
(NASA-TM-X-63949; X-641-70-245) Avail: CFSTI CSCL 20H

Using a local effective potential to account for electron exchange, the zero-energy scattering of ortho-positronium by helium atoms was analyzed. The effective potential was chosen so that the results obtained in the static approximation agreed with the static-exchange results of a previous study. Correlation was introduced in two different approximations which agree well. Author

N70-31011*# Alabama Univ., Huntsville. Research Inst.
A STUDY OF TWO-BODY STRONG INTERACTIONS OF ELEMENTARY PARTICLES Final Technical Report, 27 Jan. 1969 – 1 May 1970
J. Edwin Rush, Jr. May 1970 14 p refs
(Grant NGR-01-002-063)
(NASA-CR-110443) Avail: CFSTI CSCL 20H

The processes positive pion proton yields positive sigma hyperon positive kaon, negative pion proton yields neutral sigma hyperon neutral kaon, and negative pion proton yields negative sigma hyperon positive kaon were studied jointly in a manner similar to negative pion proton yields lamba hyperon neutral kaon. Charge independence (isospin conservation) was used to relate the three processes by two independent isospin states. All available data below 2045 MeV center-of-mass energy were surveyed, and 451 data points (differential cross-section or polarization) at about 20 different energies were selected for the final calculations. The energy limit was chosen to be one half-width above the mass of the F sub 37 (1940) resonance. Author

N70-31013# European Atomic Energy Community, Ispra (Italy).
MEASUREMENTS OF THE SCATTERING CROSS SECTIONS OF LIQUID AND SOLID HYDROGEN, DEUTERIUM AND DEUTERIUM HYDRIDE FOR THERMAL NEUTRONS [MESSUNG DER STREUQUERSCHNITTE VON FLUESSIGEM UND FESTEM WASSERSTOFF, DEUTERIUM UND DEUTERIUMHYDRID FUER THERMISCHE NEUTRONEN]
W.-D. Seiffert 1970 40 p refs In GERMAN; ENGLISH summary
(EUR-4455.d) Avail: CFSTI

Measurements of the scattering cross sections for thermal neutrons (2 to 80 meV) of liquid and solid normal-H2, para-H2, D2 and HD are presented. The scattering by liquid para-H2 and HD2 shows clearly coherent features. The cross sections of liquid and solid para-H2 and HD show the onset of inelastic scattering with excitation of the first rotational level. The measured cross sections are compared with numerical calculations. Author

N70-31071# Chicago Univ., Ill. Enrico Fermi Inst.
FACTORISATION OF SATELLITE TERMS IN THE N PARTICLE DUAL AMPLITUDE. 2. THE SINGLE PLANAR DUAL LOOP
P. H. Frampton and R. J. Rivers Mar. 1970 23 p refs
(Contract AT(11-1)-264)
(COO-264-541; EFI-70-15) Avail: CFSTI

The amplitude for a single planar dual loop is written for a loop constructed from a factorized N particle dual amplitude with satellite terms included. The end-point essential singularity, already present in the non-satellite case, is strengthened due to the increased degeneracy of the states, and there is no possibility of cancelling the singularity by manipulating the satellite coefficients. Unequal intercepts are introduced with satellite terms present. The operational coherent state formalism is used throughout to facilitate the calculation. Some remarks are made concerning the incompleteness of the analogy between the dual diagrams and the Feynman diagrams of quantum electrodynamics. Author (NSA)

N70-31097# Iowa State Univ. of Science and Technology, Ames.
TRIO, A COMPUTER PROGRAM FOR THE CALCULATION OF PHONON DISPERSION CURVES, ATOM POLATION VECTORS, AND NORMALIZED STRUCTURE FACTORS
Thomas Stephen Prevender Oct. 1969 13 p refs
(Contract W-7405-eng-82)
(IS-2186) Avail: CFSTI

A computer program is described that calculates the phonon dispersion curves, atom polarization vectors, and normalized inelastic neutron scattering structure factors for materials possessing the CsCl structure. The input data for the program include a set of Born von Karman-type force constants. The program is written in FORTRAN for use with an IBM 360-65 computer. Author

N70-31099# Sandia Corp., Albuquerque, N. Mex.
K-SHELL AUGER AND RADIATIVE TRANSITON MATRIX ELEMENTS FOR Be-Xe AND IONS OF Al AND Cl
Eugene J. McGuire Feb. 1970 21 p refs
(SC-RR-70-50) Avail: CFSTI

The Auger and radiative transition matrix elements for Be-Ti and for Ti-Xe have been calculated to compute atomic fluorescence yields. In addition rates for Al and Cl in various stages of ionization were computed. The matrix elements are published to facilitate comparison with future calculations, and/or to permit intermediate-coupling calculations of detailed Auger intensities. A list of expressions for the Auger and radiative transition rates is included. The calculations are based on a straight line approximation to the Herman – Skillman central potential for atoms and ions with a 1s hole. A list of the model parameters, model and Herman – Skillman eigenvalues, Auger and radiative matrix elements, and the fluorescence yields for the Al and Cl ions is presented. The parameters, eigenvalues, and matrix elements for the elements Be-Xe are listed. Author

N70-31181# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
USE OF A SURFACE-BARRIER DETECTOR FOR FISSION PRODUCT DETECTION BY ELECTRICAL COLLECTION [UTILISATION D'UN SEMICTEUR A BARRIERE DE SURFACE POUR LA DETECTION DE PRODUITS DE FISSION PAR COLLECTION ELECTRIQUE]
Pierre Lecomte and Roger Le Meur Mar. 1970 51 p refs In FRENCH; ENGLISH summary
(CEA-R-3959) Avail: CFSTI

One method of can rupture detection consists in extracting the fission gases from the cooling liquid of a reactor and measuring the beta activity of the decay products ionized after electrical collection. Replacement of the scintillation detector by a silicon surface barrier detector was proposed. The energy calibration and the perturbations caused by the presence of a screen were examined in detail. It was found that for the same working surface, the use of a surface barrier detector appears to be more advantageous for measurements on fission gases at ambient temperature. Author (ESRO)

N70-31188# Chicago Univ., Ill. Enrico Fermi Inst.
THE N-PARTICLE DUAL AMPLITUDE WITH SATELLITES: WARD-LIKE IDENTITIES
R. J. Rivers Feb. 1970 23 p refs

(Contract AT(11-1)-264)
(COO-264-537; EFI-70-10) Avail: CFSTI

A large class of N-pt. functions with satellites factorized in a multiperipheral configuration is examined. It is shown that the Ward-like identities due to reflection invariance do not lead to a reduction in degeneracy due to a partial ghost-killing but merely lead to the introduction of new states. This is considered to be a more serious disadvantage to the model than the large mass degeneracy that satellites imply. Author (NSA)

N70-31190# Illinois Univ., Urbana.
SEARCH FOR DIRECT PROCESSES IN TWO PION RADIATIVE DECAYS OF POSITIVE AND NEGATIVE KAONS
Ralph Thomas Edwards (Ph.D. Thesis) Feb. 1970 72 p refs
(Contract AT(11-1)-1195)
(COO-1195-171) Avail: CFSTI

Decays of positive and negative kaons were observed using a scintillation counter-optical spark chamber arrangement, and a 3.5 BeVc positive and negative kaon beam. These decays are interesting because the interference of two competing mechanisms for this decay may produce asymmetries in the partial decay rates for positive kaons and negative kaons into this mode. The mechanisms are internal bremsstrahlung and a hypothetical direct process in which the gamma is produced within the decay vertex. The fraction of direct decays is consistent with zero, and the partial decay rate for direct decay, excluding interference between direct and internal bremsstrahlung amplitudes, is less than 10% of the partial rate for internal bremsstrahlung for the kinetic energy of the charged pion between 58 and 90 MeV. So, although the size of the direct process is small relative to internal bremsstrahlung, CP asymmetries have not been shown to be unobservable. Author (NSA)

N70-31191# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
APPLICATION OF A VECTOR MESON DOMINANCE MODEL TO 2 PION AND 3 PION DECAYS OF K AND ETA MESONS
Avadis Simon Hacinliyan Mar. 1970 36 p refs
(Contract AT(11-1)-264)
(COO-264-539; EFI-70-12) Avail: CFSTI

P-wave contributions to K meson yields 3 pions and eta meson yields 3 pions decays are systematically studied by means of a vector meson dominance model. Dalitz plot fits using functional dependences of matrix elements from the above model, and p wave decay rate estimates using a generalized spurion concept yield reasonably consistent results for the p wave contribution to these decays. Author (NSA)

N70-31192# Michigan State Univ., East Lansing.
ZERO-MASS STATES IN NON-FREDHOLM BETHE-SALPETER q ANTI-q MODELS
John Connell [1970] 32 p refs Supported by AFC
(COO-1051-38) Avail: CFSTI

A qq interaction given by a (non-Fredholm) Bethe-Salpeter equation whose kernel is a sum of S, V, T, A and P single boson exchange is considered. With the heavy-quark model of mesons in mind, we determine when massless bound states of given tensor character (S,V,T,A or P) will occur, and what exchanged-particle coupling constants will produce them. The technique used is gradually to increase the magnitude of the coupling constants from zero, and determine when the lowest bound state mass descends to zero. This point is detected by the development of a singularity in the previously regular s = 0 scattering amplitude. The singular, non-Fredholm property of the Bethe-Salpeter equation allows considerable simplifications which make the calculation possible. Author (NSA)

N70-31195# Reilly Translations, Gardena, Calif.
MULTIPARTICLE STATES
L. K. Peker [1970] 41 p refs Transl. into ENGLISH from Proc. of Akad. Nauk SSSR, Leningrad, Fiz.-Tekhn. Inst. Winter School for Nucl. Theory and High Energy Phys., Pt. 1, 5-17 Feb. 1969 Prepared for UCRL
(UCRL-Trans-1399; Conf-690217-2) Avail: CFSTI

A survey on the three and four-particle states of nuclei is presented. The use of information on multiparticle structure in studying residual interactions is described. NSA

N70-31200# Commissariat a l'Energie Atomique, Limeil (France).
INELASTIC SCATTERING OF 14 MeV NEUTRONS BY Pu 239 [DIFFUSION NON ELASTIQUE DE NEUTRONS DE 14 MeV SUR Pu 239]
Francoise Bertrand and Jacques Voignier Apr. 1970 39 p refs In FRENCH; ENGLISH summary
(CEA-R-3936) Avail: CFSTI

The spectrum of 14 MeV neutrons scattered by plutonium 239 was studied by the time-of-flight method. The emission cross-section of the inelastic neutrons was measured in the range 0.4 MeV to 8 MeV. The energy distribution of inelastic neutrons was represented by an expression combining two experimental functions. ESRO

N70-31202# Iowa State Univ. of Science and Technology, Ames.
FIT, A NONLINEAR LEAST-SQUARES FITTING PROGRAM TO OBTAIN INTERATOMIC FORCE CONSTANTS FROM OBSERVED PHONON FREQUENCIES
Thomas Stephen Prevender Oct. 1969 17 p refs
(Contract W-7405-eng-82)
(IS-2185) Avail: CFSTI

The computer program described obtains the best-fit interatomic force constants of a material possessing the CsCl structure from its measured phonon dispersion curves. A general Born von Karman force constant model employing interactions up to and including sixth neighbor is used. The program is written in FORTRAN for use with an IBM 360-65 computer. Author

N70-31209# California Univ., Berkeley. Lawrence Radiation Lab.
T = 0 AND T = 1 PAIRING IN LIGHT NUCLEI
Alan L. Goodman (Ph.D. Thesis) Oct. 1969 333 p refs
(Contract W-7405-eng-48)
(URCL-19514) Avail: CFSTI

A generalized quasiparticle transformation is presented which includes n-n,p-p, and n-p (T = 0 and T = 1) pairing correlations. The quasiparticle coordinates are required to be complex. The resulting gap equations for N = Z even-even nuclei are solved for the nuclei in the sd shell. To permit interaction between the Hartree–Fock (HF) and pair potentials, the Hartree–Fock–Bogolyubov (HFB) equations, including both T = 0 and T = 1 pairing, are also solved for these nuclei. Although T = 1 pairing correlations are not significant, T = 0 pairing correlations play a very important role, rectifying many of the failures of the HF theory in this region. T = 0 pairing restores axial symmetry to the equilibrium shapes of Mg-24 and S-32 and explains the vibrational nature of Ar-36. Author (NSA)

N70-31212# Illinois Univ., Urbana.
K-PLUS PROTON ELASTIC SCATTERING AT 2.63, 2.76 AND 3.20 GEV/C
James Jonathan Whitmore (Ph.D. Thesis) Feb. 1970 137 p refs
(Contract AT(11-1)-1195)
(COO-1195-175) Avail: CFSTI

The results of a study of K(+)p elastic scattering at incident kaon momenta of 2.53, 2.76, and 3.20 GeV/c are presented. The data were obtained from exposures of the MURA 30" hydrogen bubble chamber. Differential and total elastic cross sections are given. Characterizing the kaon center-of-mass angular distributions are peaks in both forward and backward directions. The momentum dependence of both the diffraction and backward peaks in K(+)p elastic scattering is compared with the calculations of Regge pole exchange models. Also presented are some preliminary results of a phase shift analysis at 2.50 GeV/c. Author (NSA)

N70-31213# California Univ., Berkeley. Lawrence Radiation Lab.
TRAJECTORY: AN ORBIT AND ION OPTIC MATRIX PROGRAM FOR THE 184-INCH CYCLOTRON
A. C. Paul Sep. 1969 17 p refs
(Contract W-7405-eng-48)
(UCRL-19407) Avail: CFSTI

TRAJECTORY is a Fortran IV program for simultaneously integrating the equations of motion of a charged particle in a magnetic field and the differential equations for the ion optic matrix representing small motion about the paraxial trajectory. The orbit calculation is carried out in the median plane with the vertical transformation matrix calculated from a Taylor-series expansion of the magnetic field off the median plane. The matrix so calculated is readily used with the ion-optic transport codes TRANSPORT or OPTIK. The trajectory data can be used to obtain internal target positioning for a given beam line. Author (NSA)

N70-31222# Oak Ridge National Lab., Tenn.
MEASUREMENTS OF (D,N) REACTIONS ON NI 58, NI 60, NI 62, and NI 64 AT 5 AND 10 MEV
Alex L. Marusak (Ph.D. Thesis—Tenn. Univ.) Feb. 1970 133 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2472) Avail: CFSTI

Absolute differential cross sections for Ni-58(d,n)Cu-59, Ni-60(d,n) Cu-61, Ni-62(d,n) Cu-63, and Ni-64(d,n) Cu-65 at 5 and 10 MeV were measured by time-of-flight techniques in order to obtain energy levels, l-values, and spectroscopic strengths for the odd-A copper isotopes, and to compare these results with those obtained from the (He-3,d) and (alpha,t) proton stripping reactions. Angular distributions were compared with predictions of DWBA theory using optical model potentials of the Woods-Saxon form, taking into account nonlocality, spin-orbit terms, and finite-range effects in the (p,n) interaction. Optical model parameters were obtained from elastic scattering of deuterons on Ni-60. Relative spectroscopic strengths of the first few low-lying levels in the odd-A copper isotopes are in marked disagreement with those predicted by the simple excited-core model, but in fair agreement with predictions of more extended models. Author (NSA)

N70-31228# Utah Univ., Salt Lake City.
DIRECT MOBILITY AND REACTION: DIFFUSIONAL AND RATE THEORY FORMULATIONS IN ONE AND THREE DIMENSIONS
M. Simpson and A. Sosin [1969] 72 p refs
(Contract AT(11-1)-1800)
(COO-1800-7) Avail: CFSTI

The migration of defects leading to eventual reaction is analyzed on the basis of diffusion theory and compared with chemical rate theory. A diffusional treatment is carried out in detail and in special cases of particular interest. Correlations between interstitials and vacancies, typical of metals following electron irradiation, are examined. Trapping by impurities and dislocations, thermal conversion, and high-temperature bombardment are also treated. In each case, formulations are developed along both one- and three-dimensional diffusion models. These alternative results are compared with experiments, particularly, annealing in copper irradiated by electrons at low temperature. The results support the conclusion that the defect which migrates in Stage 1 diffuses in three dimensions. Author (NSA)

N70-31231# Oak Ridge National Lab., Tenn.
UKE: A COMPUTER PROGRAM FOR TRANSLATING NEUTRON CROSS SECTION DATA FROM THE UKAEA NUCLEAR DATA LIBRARY TO THE EVALUATED NUCLEAR DATA FILE FORMAT
R. Q. Wright, S. N. Cramer, and D. C. Irving Mar. 1970 22 p refs
(AD-703679; ORNL-TM-2880) Avail: CFSTI CSCL 20/8

A computer program, UKE, has been written to translate neutron cross sections on computer tape from the United Kingdom Atomic Energy Authority Nuclear Data Library to the Evaluated Nuclear Data File, ENDF/B. The code will translate UK library smooth cross section data, secondary angular distributions, and secondary energy distributions to the ENDF/B format. No resonance parameters, thermal scattering data, or photon data are considered, however. The secondary angular distributions are translated as differential scattering probabilities only, and no Legendre expansion coefficients are given. General information is presented concerning the format of the two libraries along with a detailed description of the translation from the UK secondary energy distribution laws to those of ENDF/B. Programming details and a users guide are also presented. Author (TAB)

N70-31234# Los Alamos Scientific Lab., N. Mex.
PERTURBATION TRANSFORMATION OF NUCLEAR CROSS-SECTION PARAMETERS BETWEEN WIGNER–EISENBUD AND KAPUR–PEIERLS FORMALISMS: THE PERTA PROGRAM
Donald R. Harris 25 Nov. 1969 16 p refs
(Contract W-7405-eng-36)
(LA-4327) Avail: CFSTI

The transformation between nuclear cross sections in the Wigner–Eisenbud and Kapur–Peierls formalisms is expressed by treating off-diagonal elements of the inverse level matrix as perturbations. A FORTRAN IV program, PERTA, is developed to compute the perturbation transformation. The applicability of the perturbation to real nuclei is tested for low-energy neutron cross sections of fissile nuclides. The perturbation transformation is applied to the study of properties of Kapur–Peierls parameters, namely, their probability distribution, the range in energy of interference effects, and the degree of asymmetry of resonant shapes of radiative capture cross sections. Author (NSA)

N70-31237# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
USERS MANUAL FOR DOT2DB: A TWO-DIMENSIONAL MULTIGROUP DISCRETE ORDINATES TRANSPORT/DIFFUSION CODE WITH ANISOTROPIC SCATTERING
R. Protsik and E. G. Leff Sep. 1969 84 p refs
(Contract AT(04-3)-189)
(GEAP-13537) Avail: CFSTI

Instructions for the use of the DOT2DB program are presented. DOT2DB solos both the multigroup discrete ordinates transport and the multigroup diffusion equations with anisotropic scattering in two dimensions by iterative procedures. The program is in FORTRAN IV and is designed for the GE635 computer. NSA

N70-31241# Brookhaven National Lab., Upton, N.Y. Information Div.
DOUBLE-HUMPED FISSION BARRIER AND

NEUTRON-INDUCED NUCLEAR FISSION
E. V. Gai et al Dec. 1969 17 p refs Transl. into ENGLISH from Yadern. Fiz. (USSR), v. 10, no. 3, 1969 p 542–548
(BNL-tr-311) Avail: CFSTI

The energy dependence of the penetration for a two-bump potential barrier with a well between the maxima is calculated in the quasiclassical approximation. It is shown that the penetration oscillates sharply, increasing to the maxima for energies near the quasilevels of the well. The results are applied for analysis of the experimental data on neutron-induced nuclear fission. Author (NSA)

N70-31247# Illinois Univ., Urbana.
MESON AND BARYON PRODUCTION IN THE REACTION PION(+) DEUTERON YIELDS PROTON PROTON PION(+) PION(−) PION(0) AT 4.19 GeV/c
Howard Alan Gordon (Ph.D. Thesis) Feb. 1970 124 p refs
(Contract AT(11-1)-1195)
(COO-1195-179) Avail: CFSTI

A study of 1809 events of the reaction positive pion deuteron yields proton proton positive pion negative pion neutral pion at 4.19 GeV/c incident pion momentum is reported. The experiment was done in a 72 in. deuterium bubble chamber. A significant amount of beam contamination is found but shown not to be present in the events selected for analysis. A considerable amount of proton production is found. The clearest feature of the data is the neutral omega production with a cross section sigma(positive pion neutron yields neutral omega proton) = 0.36 + or − 0.05 mb. A simple Regge model calculation with proton + B exchange does not reproduce the data. Evidence is given for simultaneous proton delta (1236) production produced by one-pion exchange. Enhancements are seen in the three pion spectrum. The data alone cannot prove that the I = 0 assignment for the ε'pha is correct. Author (NSA)

N70-31248# Chicago Univ., Ill.
RHO OMEGA MIXING: THE MIXING FORMALISM AND PHENOMENOLOGICAL THEORIES
Jorge F. Willemsen Feb. 1970 31 p refs
(Contract AT(11-1)-264)
(COO-264-538; EFI-70-11) Avail: CFSTI

Previously undiscussed details of a general propagator mixing formalism for vector mesons, including consideration of both mass and kinetic terms, are presented. Specifically, it is shown how dynamic self-energy effects contribute to the kinetic terms, leaving the mass matrix real; the mixing problem is solved in the case of constant matrices; and a Bell–Steinberger type unitarity relation appropriate for vector mesons is displayed. Further, it is shown that the near degeneracy of rho and omega mesons makes it very difficult to distinguish between mass-mixing and current-mixing phenomenological parameters, but that a small and perhaps detectable difference for the magnitude of these parameters is predicted by the respective models in the Coleman–Glashow symmetry breaking scheme. The significance of the difference is discussed. Author (NSA)

N70-31249# Brookhaven National Lab., Upton, N.Y.
NEUTRON RESONANCES OF GADOLINIUM ISOTOPES
E. N. Karzhavina et al Jan. 1970 18 p refs Transl. into ENGLISH from Yadern. Fiz. (USSR), v. 9, 1969 p 897–905
Sponsored by AEC
(BNL-TR-322) Avail: CFSTI

Transmission and radiative capture by Gd isotopes are measured by means of a neutron spectrometer. Parameters of the neutron resonances of the isotopes are obtained by the method of area analysis. Data on the resonance parameters are presented. Values of mean distance between the levels, of strength function, of mean radiative width and of the parameter of the level density are given for the Gd isotopes. Mean distances between the levels of the isotopes Sm-152 and Sm-154 are also given. For these isotopes measurements of the neutron radiative capture are fulfilled that makes it possible to determine the position of the neutron resonances. Author (NSA)

N70-31251# Pittsburgh Univ., Pa. Wherrett Lab. of Nuclear Chemistry.
NUCLEAR CHEMISTRY RESEARCH: RECOIL STUDIES OF NUCLEAR REACTIONS Annual Report, Jan. – Dec. 1969
Robert L. Wolke Dec. 1969 56 p refs
(Contract AT(30-1)-2771)
(NYO-2771-36) Avail: CFSTI

A recoil study of the C-12(d,alpha) B-10 reaction is reported. Progress in the development of targets for the recoil experiment is also reported. NSA

N70-31252# Chicago Univ., Ill. Enrico Fermi Inst.
BETA DECAY OF THE LAMBDA HYPERON
Roland Winston 1970 20 p Presented at Ann. Meeting of the Am. Phys. Soc., Chicago, Jan. 1970 Sponsored by AEC
(COO-1701-10; EFI-70-9; CONF-700102-3) Avail: CFSTI

Some preliminary results on Lambda hyperon yields p + e + antineutrino decay are reported. At the completion of the data analysis, the ratio of axial-vector to vector amplitudes will be determined to <0.1 and the relative phases to about 10°. Optical spark chambers and gas Cerenkov and scintillation counters are used for this study. NSA

N70-31257# California Univ., Livermore. Lawrence Radiation Lab.
THE 'HUTCH' HEAVY ELEMENT EXPERIMENT: EARLY RESULTS AND CONCLUSIONS
S. F. Eccles and E. K. Hulet 24 Oct. 1969 15 p refs
(UCRL-50767) Avail: CFSTI

A new thermonuclear device, designed to produce isotopes of the heaviest elements by exposing a uranium and thorium target to a very intense neutron flux, was exploded in July 1969. Although detailed calculations of the heavy element mass distribution have not been completed, the neutron exposure of the target was estimated at approximately 45 moles/sq cm, which is better than twice the exposure in the best previous test. Thorium contributes to the mass-yield curve only at the lowest masses, and the odd-even reversal (due to capture in an odd z-target) seen in the previous experiments is not present. Because of the increased neutron exposure, extraordinarily large amounts of known heavy isotopes were produced. The total amount of Fm-257 in the debris, 0.25 mg, exceeds the current reactor production of this isotope by 10 to the 10th power. The amount of Cm-250 produced was 40 mg. The search for new isotopes with mass numbers greater than 257 was unsuccessful. Author (NSA)

N70-31258# Florida Univ., Gainesville. Nuclear Chemistry Group.
NUCLEAR CHEMISTRY GROUP PROGRESS REPORT, DECEMBER 1968 – NOVEMBER 1969
M. L. Muga 1969 69 p refs
(Contract AT(40-1)-2843)
(ORO-2843-15) Avail: CFSTI

The problem of distinguishing fission fragment scattering processes from ternary fission process was studied. Kinetic energy distributions of alpha particles and fission fragments and fragment mass distributions were measured for thermal neutron-induced fission of uranium-235. Energy loss (dE/dx) measurements of uranium-235 fission fragments as a function of mass and energy using time-of-flight techniques are presented and discussed. Also the development of the thin-film scintillation detector for fission

fragment time-of-flight measurements, for fission fragment energy loss measurements, and for other uses is described. NSA

N70-31283# National Accelerator Lab., Batavia, Ill.
X-RAYS FROM MUON, PION, KAON, AND SIGMA-MINUS CAPTURE IN THE LIGHT ELEMENTS
S. Berezin (ANL, Ill.), G. Burleson (Northwestern Univ.), D. Eartly (ANL, Ill.), A. Roberts, and T. O. White Dec. 1969 90 p refs Sponsored by AEC
(NAL-37) Avail: CFSTI

A search for X-rays from the capture of kaons in helium has disclosed neither K- nor L-series radiation; the upper limit of the X-ray yield is in the range 7 to 10 percent. This contradicts results of an earlier measurement but is in better agreement with related data on kaon-helium scattering. In the same experimental arrangement, the yields of pionic and muonic X-rays in helium were also measured. Anomalously low yields were found, accompanied by intensity distributions of the K-series members in disagreement with the conventional cascade picture of a predominantly circular set of orbits. Monte Carlo cascade calculations could not duplicate the observed results unless weak Stark mixing, in the form of sliding transitions (n, 1 yields n,1 + or − 1) was added. Agreement with observation was achieved in muonic, pionic, and kaonic atoms with a single value for the parameter describing the strength of the Stark mixing. Author (NSA)

N70-31287 Paris Univ., Orsay (France). Lab. de Chimie Physique.
TRANSITIONS 4p-nd, ns IN THE SPECTRA Zr V, VI, VII, Nb VI, VII, VIII AND Mo VII, VIII, IX
Mirza Said-uz-Zafar Chaghtai 30 May 1969 5 p refs Presented at the 1st Ann. Meeting of Europ. Assoc. on Atomic Spectry., Paris, 2 - 5 Jul. 1969; sponsored by CNRS
Avail: Issuing Activity

A brief account of 4p-nd, ns transitions in the spectra Zr V, VI, VII, Nb VI, VII, VIII and Mo VII, VIII, IX, are given. Four of these spectra were studied for the first time and the others were thoroughly revised. The corresponding isoelectronic sequences are reviewed. Author (ESRO)

N70-31281# Northeastern Univ., Boston, Mass. Dept. of Physics.
PHASES AND FORWARD CROSS SECTIONS IN VECTOR MESON PHOTOPRODUCTION
Gary K. Greenhut Apr. 1970 42 p refs
(Grant NSF GP-9217)
(NUB-2008) Avail: Issuing Activity

Using a quark model for forward scattering and Regge pole parameterization of meson-nucleon scattering amplitudes, d sigma/dt sub t=0 and the phases of the forward scattering amplitudes are calculated for p(o), omega and phi photoproduction and compared with the experimental data. Author

N70-31293# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
CALCULATING NEUTRON FLUX IN SUBCRITICAL MASSES [CALCULO DE FLUXOS DE NEUTROES EM CONJUNTOS SUBCRITICOS]
H. Machado Jorge and J. Salgado 1969 18 p refs In PORTUGUESE
(LFEN-NI.44/ALPHA/) Avail: CFSTI

The neutron flux distribution of thermal and fast neutrons in subcritical masses are analyzed along the axis of symmetry, for developing a computer program for calculating the flux. Models are developed for obtaining the flux in a mass of known configuration, and the application to a typical case is included. Transl. by F.O.S.

N70-31298 Paris Univ. (France). Lab. de Chimie Physique.
X-RAY SPECTROSCOPIC STUDY OF DOUBLY IONIZED STATES [ETUDE PAR SPECTROSCOPIE X D'ETATS DOUBLEMENT IONISES]
C. Bonnelle, C. Senemaud, and F. Wuilleumier 1969 4 p refs In FRENCH Presented at the 1st Ann. Meeting of European Assoc. on Atomic Spectry., Paris, 2 - 5 Jul. 1969; sponsored by CNRS
Avail: Issuing Activity

X-ray emission and absorption spectra give data on the simultaneous excitation and ionization probability of two electrons and measurements of the K alpha secondary emission of sodium, magnesium and aluminum and the X absorption spectra of rare gases are presented. The ratio of the single to the double ionization probability does not depend on the nature of the ionizing radiation and appears to be a characteristic of the atom. ESRO

N70-31310# Texas A&M Univ., College Station. Cyclotron Inst.
ANGULAR MOMENTUM EFFECTS IN NUCLEAR REACTIONS Progress Report, 1 Jan. - 31 Dec. 1969
J. B. Natowitz Dec. 1969 59 p refs
(Contract AT(40-1)-3924)
(ORO-3924-4) Avail: CFSTI

Measurements of complete fusion cross sections in the reactions of heavy ions with Cu, Ag, Au, and Bi targets were completed. Interpreted in terms of a simple sharp cut-off model, these measurements suggest a limit to the angular momentum of compound nuclei formed in heavy ion reactions. The systematics of such reactions were used to calculate complete fusion cross sections for Ni-64, Kr-86, and Xe-136 projectiles. Track detector techniques were used to measure excitation functions for the production of fission isomers in (alpha, xn) reactions on Np-237 and U-238. A study of the emission of Li, Be and B fragments in the reactions of alpha particles with Al and Ag was initiated. A gas scintillation detector was constructed and tests are underway to determine the optimum conditions for use of this detector to study spontaneous fission isomerism. Author (NSA)

N70-31314# Iowa State Univ. of Science and Technology, Ames.
HYPERON-ANTIHYPERON PRODUCTION IN ANTIPROTON PROTON INTERACTIONS AT 2.4 AND 2.9 GeV/c
Terry Le Roy Schalk (Ph.D. Thesis) Nov. 1969 63 p refs
(Contract W-7405-eng-82)
(IS-T-354) Avail: CFSTI

The results of a study of hyperon-antihyperon production in 2.4 and 2.9 Gev/c antiproton interactions are presented. The experiment had a sensitivity of 2.2 events/microbarn. Three examples of Xi hyperon(-) anti-Xi hyperon(-) production at 2.9 GeV/c were observed. The lambda hyperon anti-Lambda hyperon and Lambda hyperon anti-Sigman hyperon(0) + c.c. final states were observed to be highly peripheral, indicating a t-channel exchange dominance. However, a prediction for the differential cross section from a one meson exchange model with absorption, done for a slightly higher momenta (3.0 GeV/c), is not as sharply peaked as the data. The three-body final states are produced peripherally only when the reaction is consistent with t-channel exchange of a known particle, and then only weakly. There is evidence for some Sigma hyperon(1385), Lambda hyperon(1404) and Lambda hyperon(1520) production in these three-body final states, however the statistics are very limited. Author

N70-31323# Ballistic Research Labs., Aberdeen Proving Ground, Md. Nuclear Effects Lab.
GE(Li) DETECTOR STUDY OF GAMMA RAYS FROM GROUND-STATE DECAY OF IRIDIUM-190
Judith K. Temperley and Donald E. Barnes Dec. 1969 29 p refs
(AD-702889; BRL-R-1460) Avail: CFSTI CSCL 20/8

The gamma-ray spectrum following the decay of 190gIr to 190Os was investigated with a Ge(Li) detector. The energies and relative intensities of 42 gamma rays, including ten transitions previously unreported, were determined. Using the conversion electron intensities measured by previous investigators, the K-conversion coefficients of the transitions were calculated and used to assign spins and parities to the levels of 190Os. Author (TAB)

N70-31328# Brookhaven National Lab., Upton, N.Y.
PARTICLE IDENTIFICATION AT RELATIVISTIC ENERGIES BY THE USE OF SECONDARY EMITTERS
J. Llacer [1970] 21 p refs Presented at the 12th Scintillation and Semiconductor Counter Symp., Washington, D.C.
(BNL-14466; CONF-700301-4) Avail: CFSTI

The usefulness of negative-electron-affinity secondary emitters as detectors of particles in the high relativistic region is studied theoretically in detail. It is found that GaP(Cs) has poor secondary escape statistics, resulting in the inability to distinguish between 200 GeV/c protons and pions in single particle experiments. GaAs has good escape statistics, but its active depth may be too large, and density effects are expected to set in. A GaP(1 − x) − GaAs heterojunction which could solve both problems is discussed. In any case, it is found that nonlinear filtering of the near Landau distributed signals from secondary emitters is required in order to obtain useful particle discrimination. One feasible scheme is proposed which should allow separating 200 GeV/c protons and pions, for example, with 90% efficiency or better at near 100% confidence. Author (NSA)

N70-31330# Oak Ridge National Lab., Tenn.
RADIOISOTOPE PROGRAM (8000) Progress Report, Feb. 1970
A. F. Rupp Mar. 1970 28 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2910) Avail: CFSTI

Efforts devoted to production and distribution of radioisotopes are summarized. Information is included on biomedical radioisotopes, research isotopes, isotopes for power, fission products, radiation source development, applications development, sales, and processing. Author (NSA)

N70-31352# Argonne National Lab., Ill.
FAST-NEUTRON TOTAL AND SCATTERING CROSS SECTIONS OF BISMUTH
A. B. Smith, J. F. Whalen, E. Barnard (Atomic Energy Board, Pretoria, South Africa), J. A. M. de Villiers (Atomic Energy Board, Pretoria, South Africa) and D. Reitmann (Atomic Energy Board, Pretoria, South Africa) Nov. 1969 32 p refs
(Contract W-31-109-eng-38)
(ANL-7636) Avail: CFSTI

Total neutron cross sections of bismuth were measured with resolutions of approximately 1 keV over the energy range 0.2 to 1.4 MeV. Differential elastic scattering cross sections were determined at intervals greater than 50 keV from 0.3 to 1.5 MeV with resolutions of approximately 20 keV. The inelastic neutron excitation of a state of 896 + or − 1 keV was observed, and the respective differential excitation cross sections determined with incident resolutions of approximately 0 keV. Partially resolved resonance structure was evident in all the measured values. The experimental results were assayed for possible intermediate structure and were compared with the results of optical-model and statistical calculations. The model calculations were cognizant of the fluctuation and correlation of compound-nucleus resonance widths and of the shell closure at N = 126. Author (NSA)

N70-31353# Tennessee Univ., Knoxville.
[HIGH ENERGY PHYSICS] Progress Report
W. M. Bugg, G. T. Condo, and E. L. Hart [1970] 5 p refs
(Contract AT(40-1)-3956)
(TID-25359) Avail: CFSTI

A summary of research is presented on meson interactions with deuterium and slow meson and hyperon capture by neon nuclei. A list of publications issued during this period is appended. NSA

N70-31361# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
POLARIZATION EFFECTS IN ELASTIC ELECTRON SCATTERING [POLARISATIONSEFFEKTE BEI DER ELASTISCHEN ELEKTRONENSTREUUNG]
W. Eckstein Feb. 1970 132 p refs In GERMAN; ENGLISH summary
(IPP-7/1) Avail: CFSTI

Elastic electron scattering and the resulting spin polarization effects are reviewed. The energies range from 1 eV to about 1 MeV, and the range of scattering angles is above about 20 deg. Methods of calculating the differential cross sections and Sherman functions are described and experimental results are compared with theoretical values. Polarization measurements by scattering are discussed in detail. Author (ESRO)

N70-31367 Paris Univ., Orsay (France). Lab. de Chimie Physique.
PHOTOIONIZATION CROSS SECTIONS OF HEAVY ATOMS: THEORETICAL STUDY WITH CENTRAL POTENTIAL MODEL [SECTIONS EFFICACES DE PHOTOIONISATION DES ATOMES LOURDS: ETUDE THEORIQUE DANS UN MODELE A POTENTIEL CENTRAL]
Francoise Combet-Farnoux 1969 4 p refs In FRENCH Presented at the 1st Ann. Meeting of Europ. Assoc. on Atomic Spectry., Paris, 2-5 Jul. 1969; sponsored by CNRS
Avail: Issuing Activity

Photoionization cross section computations concerning the sub-shells 4d, 4f, 5p, 5d, 5f, and 6p in atoms with atomic number 2 greater than or = to 71, performed with a non-relativistic monoelectronic model with central potential, showed important variations of the absorption coefficient in a range from the far ultraviolet to the soft X-ray region. ESRO

N70-31390# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali.
A PROGRAM FOR CALCULATING THE MAGNITUDE OF SINGLE PHOTOPRODUCTION OF PIONS FROM NUCLEONS [UN PROGRAMMA DI CALCOLO PER LE GRANDEZZE DELLA FOTOPRODUZIONE SINGOLA DI PIONI DA NUCLEONI]
M. Nigro (Padua Univ.), P. Spillantini, and V. Valente 14 Oct. 1969 14 p refs In ITALIAN *Its* Nota Interna No. 453
(LNF-69/59) Avail: CFSTI

A computer program for measuring single photoproduction of pions form nucleons is presented. The input data of the program are the elementary amplitudes, and the phase scattering of the pion-nucleon reaction. The general expressions for photoproduction amplitudes are given, and the development of the amplitudes for all processes as functions of amplitudes, with the state of isospin, and the ties between the real and imaginary amplitudes are included. An example of the program application is also included. Transl. by F.O.S.

N70-31394# California Univ., Livermore. Lawrence Radiation Lab.
HO 166, EU 151 AND NATURAL EUROPIUM CAPTURE CROSS-SECTION MEASUREMENTS
J. B. Czirr 12 Feb. 1970 7 p refs
(UCRL-50804) Avail: CFSTI

Neutron time-of-flight techniques were used to measure

the neutron capture cross sections for Ho-165, Eu-151 and natural Eu in the 200-eV to 12-keV energy range, with the Livermore 33-MeV linac providing the pulsed neutron source. The detector for the de-excitation gamma rays consisted of a 1-liter liquid scintillator viewed by a single photomultiplier tube. These capture-gamma events were pulse-height weighted on-line to obtain a signal which is independent of variations in the gamma spectrum. Author (NSA)

N70-31395# Michigan State Univ., East Lansing.
THE EFFECT OF CORE POLARIZATION OF THE BI 209 (P, P PRIME) BI 209 (L.61 MEV) REACTION AT 39.5 MEV
W. Benenson, S. M. Austin, P. J. Locard, F. Petrovich, M. Mc Manus, and J. R. Borysowicz [1970] 11 p refs Supported in part by NSF and AEC
(COO-1051-40) Avail: CFSTI

Core polarization is important in the excitation of the 1.609-MeV state of Bi-209 in the (p,p prime) reaction at 39.5 MeV. This transition involves a single proton going from the LH sub 9/2 to the Li sub 13/2 level. It is shown that most of the observed cross section is due to admixtures of the state formed by coupling the valence proton of Bi-209 to the highly collective 3(-) state of Pb-208 at 2.614 MeV. The macroscopic vibrational model is used to describe the core, and the admixture found is consistent with that implied by other recent experiments. A completely microscopic calculation, in which the treatment of core polarization is based on the work of Kuo and Brown, grossly underestimates the L = 3 component of cross section. Author (NSA)

N70-31397# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali.
IMPLICATIONS OF DEEP INELASTIC MUON-NUCLEON SCATTERING ON COSMIC-RAY PHENOMENA
C. Castagnoli (CNR), E. Etim, and F. Picchi 22 Sep. 1969 8 p refs *Its* Nota Interna No. 450
(LNF-69/56) Avail: CFSTI

By analysis of cosmic ray experiments it is shown that for large values of photon energy, a previously derived equation for the absorption of transverse photons on a nucleon expanded in a convergent series for small values of invariant momentum transfer, in invalid. The Bjorken inelastic sum rule for asymtotic cross-sections is shown to be unsaturated. Author

N70-31413# Los Alamos Scientific Lab., N.Mex.
THE MEDIUM-ENERGY PHYSICS PROGRAM Quarterly Status Report, Period Ending 31 Jan. 1970
25 Mar. 1970 46 p refs
(Contract W-7405-eng-36)
(LA-4384) Avail: CFSTI

Topics include the safety program, construction of accelerator structures, rf power systems, accelerator control and instrumentation, accelerator physics, the experimental area, LAMPF users group, LAMPF scheduling and construction, and physics research. NSA

N70-31451# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
CHARGE COLLECTION EFFICIENCY OF IONIZATION CHAMBERS IN THE PRESENCE OF CONSTANT OR VARIABLE RADIATION INTENSITIES [EFFICACITE DE LA COLLECTION DES CHARGES DANS LES CHAMBRES D'IONISATION EN PRESENCE D'UNE INTENSITE DE RAYONNEMENT IONISANT CONSTANTE OU VARIABLE]
Jean-Claude Decuyper (Ph.D. Thesis—Grenoble Univ., 6 Sep. 1968) Mar. 1970 155 p refs In FRENCH; ENGLISH summary
(CEA-R-3844) Avail: CFSTI

A theoretical and experimental study of the collection of carriers built up by ionization in standard chambers was made by varying the different parameters. With constant ionization intensity and a DC and then an AC voltage, the effects of geometry, recombination, diffusion and attachment were analyzed. The compensation of thermal neutron DC chambers was also considered. The effect of recombination on current response, and on the collection efficiency for all liberated charges was also studied with a time-dependent ionization intensity and a DC voltage. Author (NSA)

N70-31486# Minnesota Univ., Minneapolis. Dept. of Chemistry.
NOTE ON RADIATIVE TRANSITIONS
Sanford Lipsky 1 Mar. 1970 13 p refs Sponsored by AEC
(COO-913-39) Avail: CFSTI

The general problem is discussed of how to properly formulate an expression for the radiative decay rate of a large molecule when there exists an alternative decay channel which is nonradiative. A somewhat simpler form of Fano's technique is employed based essentially on the normalization properties of the outgoing and incoming solutions of the Lippmann-Schwinger equation. Author

N70-31503# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
TWO-BODY NUCLEAR INTERACTION CURRENTS [LES COURANTS D'INTERACTION NUCLEAIRES A DEUX CORPS]
Marc Chemtob (Ph.D. Thesis—Paris Univ., 25 Nov. 1969) Mar. 1970 141 p refs In FRENCH; ENGLISH summary Sponsored by Inst. Natl. des Sci. et Tech. Nucl.
(CEA-R-3960) Avail: CFSTI

A systematic study was made of the role of meson exchange currents in the electromagnetic properties of nuclei. The description of the non-additive (two-body) part of the electromagnetic interaction was based on a non-covariant formalism using the expansion of the field-theory S-matrix in the interaction representation. General expressions for the exchange currents associated with the processes involving the exchange of one pion as well as the exchange of the heavy mesons eta, pi, rho, and omega, were derived. The multiple scattering corrections to the one-pion-exchange process were also examined. The model was used to analyze the exchange effect on the static dipole magnetic moment of odd-mass-nuclei with jj closed-shells plus (or minus) one nucleon, described within the framework of the pure spherical shell model. In the second application the role of exchange current in the electron scattering excitation of isospin 1 states in C-12 lying above 14 MeV was investigated. The last application concerned the anomaly in the magnetic moments of mirror nuclei He-3 and H-3. Author (ESRO)

N70-31523# Chicago Univ., Ill. Enrico Fermi Inst.
COMPLEX POMERANCHUK TRAJECTORIES
Reinhard Oehme Mar. 1970 12 p refs
(Contract AT(11-1)-264)
(COO-264-542; EFI-70-16) Avail: CFSTI

Models for diffraction scattering are presented which contain complex Pomeranchuk trajectories and moving branch points of the type generated by these trajectories. Poles and cuts are correlated so as to remove unwanted branches of the pole surfaces from the physical sheet. Author (NSA)

N70-31525# Brown Univ., Providence, R.I. Dept. of Physics.
S-MATRIX ANALYSIS OF K SUB I3 FORM FACTORS: ZERO OF THE KAON PION AMPLITUDE AND THE PARAMETER xi
Kyungsik Kang [1969] 10 p refs Sponsored in part by AEC
(NYO-2262-TA-216) Avail: CFSTI

An S-matrix calculation of the K sub I3 form factors is presented which gives the parameter xi approximately equal to 1 in excellent agreement with the recent experiments. Existence of

a zero in the Kpi threshold plays an important role. Implications of the amplitude zero to the off-mass-shell extrapolation of the form factors are briefly discussed. Author (NSA)

N70-31527# Bettis Atomic Power Lab., Pittsburgh, Pa.
NEUTRON CAPTURE IN PROTACTINIUM-233 (LWBR DEVELOPMENT PROGRAM)
D. R. Harris Dec. 1969 34 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-814) Avail: CFSTI

Neutron capture in protactinium-233 affects the design of water-cooled breeder reactors both by reducing the fissile U-233 formed from fertile thorium and by harming the neutron economy in the reactor. Successful prediction of the Pa-233(n,gamma) rate depends largely on use of adequate cross sections, and these are examined here in terms of the resonance capture integral and the Pa-233(n,gamma) cross section at 0.0253 eV. The transmission measurements of Simpson and Codding are analyzed to determine a resonance integral above 0.5 eV of 917 + or − 63 barns, where the contribution from the range 18 to 37.5 eV is found from an area analysis carried out. The Pa-233(n,gamma) cross section at 0.0253 eV is determined from the transmission measurements to be 47 + or − 4 barns, including the contribution from an anomalous 0.43 eV resonance. Averages of direct measurements of resonance integral and thermal cross section are smaller, 846 + or − 29 barns and 40.5 + or − 3.5 barns, respectively. These depend on standard data for gold and cobalt and these are reviewed. A composite of both integral and differential data implies 852 + or − 26 barns and 43 + or − 3 barns for resonance integral and 0.0253 eV cross section, respectively, for P-233 (n,gamma) corresponding to a 7% reduction in cross sections inferred from the transmission measurements. Author (NSA)

N70-31553# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
COULOMB PRODUCTION OF N*(1236)
Y. Nagashima and J. L. Rosen 3 Nov. 1969 17 p refs
(Contract AT(30-1)-875)
(UR-875-295) Avail: CFSTI

The cross section of N + gamma sub C yields N* in the Coulomb field of a nucleus is calculated. This process may provide the basis for a new scheme for high energy neutron detection with excellent energy and directional properties. The cross section is directly related to the well established process of N* photoproduction gamma + N yields N* so that the absolute efficiency of the neutron detection scheme may be predicted with some reliability. The possibility of constructing a tagged neutron or antineutron beam is also briefly discussed. Author (NSA)

N70-31554# Texas Univ., Austin. Center for Nuclear Studies.
RESEARCH IN NUCLEAR PHYSICS
Dec. 1969 97 p refs
(Contract AT(40-1)-2972)
(ORO-2972-123; PR-8) Avail: CFSTI

Research progress at the University of Texas Center for Nuclear Studies during 1969 is reported. The work included studies on analog resonances, direct reactions, ion-atom collisions, instrumentation, and other subjects. NSA

N70-31572*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEMICLASSICAL THEORY FOR MOLECULAR AUTOIONIZATION
Burke Ritchie Jun. 1970 15 p refs Submitted for publication
(NASA-TM-X-63951; X-641-70-208) Avail: CFSTI CSCL 18H

In the limit of high vibrational and electronic principal quantum numbers a semiclassical model for autoionization of diatomic molecules has been constructed. The molecular vibrations are treated as classical oscillators, whose parameters are chosen from a knowledge, which can be taken either from theory or experiment, of the positions of the quantal vibrational levels and the position and depth of the minimum of the adiabatic potential curve of the residual molecular ion. The theory is designed for the case where vibrational quantum numbers are greater than about 10. Electronic quantum numbers are restricted by the requirement that they be high enough so that the excited electron-core electron interaction can be represented by the monopole term in the region where the distance of the excited electron from either nucleus is always greater than the distance of the core electron and the excited electron-nuclear interactions can be represented by the monopole terms in all regions. Author

N70-31638# Gulf General Atomic, San Diego, Calif.
THEORETICAL AND COMPUTATIONAL RADIATION HYDRODYNAMICS. VOLUME 2: THE DRAD CODE WITH COMPTON SCATTERING Interim Report
Howard L. Wilson, William B. Lindley, L. N. Matteson, and G. C. Pomraning 26 Oct. 1969 248 p refs
(Contract DASA01-69-C-0012)
(AD-703664; GA-9530-Vol-2; DASA-2392-2) Avail: CFSTI CSCL 20/8

The report is divided into four volumes as follows: Volume 1 (AD-703 293) gives theoretical consideration of radiation hydrodynamics including radiation transfer in a moving medium, effects of polarization on radiative transfer, the extended Eddington approximation and surface curvature. The present volume (Volume 2) contains a description of the nonequilibrium diffusion code, DRAD, with Compton scattering. Detail discussions are also given for retardation and flux limiters. Author (TAB)

N70-31662*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONG-RANGE ATOMIC INTERACTION POTENTIALS FOR NITROGEN
Willard E. Meador Washington Jul. 1970 25 p refs
(NASA-TN-D-5882; L-5569) Avail: CFSTI CSCL 18H

Valence-bond expressions were derived for the outer regions of the four interaction potentials governing collisions between ground-state nitrogen atoms. Although the individual potential tails are probably not very accurate in an absolute sense, the relations obtained between the four energy states are expected to be reliable. Hence, the combination of the present results with a minimum amount of experimental data proves adequate for most thermodynamic and kinetic-theory applications. A principal advantage of the present method over the previous and similar work is the use of detailed correlations between the molecular states and the actual atomic products. The results of these correlations are distinguished by additional symmetries of the potential tails. Only the most repulsive and most attractive potentials were found in similar work to be mirror images of each other, the present research predicts the same property also for the intermediate pair of curves. Finally, the intermediate potentials are expressed for the first time as simple fractions of the ground-state molecular energy and thus require less experimental data for the complete semiempirical specification of nitrogen collisions. Author

N70-31668# Johns Hopkins Univ., Baltimore, Md. Dept. of Biochemistry.
CHEMICAL STUDY OF THE EFFECTS OF RADIATION ON NUCLEIC ACIDS AND RELATED COMPOUNDS Annual Progress Report, 15 Jun. 1969 – 14 Jun. 1970
Shih Yi Wang 14 Jun. 1970 5 p
(Contract AT(30-1)-4106)

(NYO-4106-1) Avail: CFSTI

Studies were made on the X-radiolysis of purine and pyrimidine bases such as guanine, adenine, thymine, uracil, and cytosine. Following X-irradiation and subsequent dilution the uv absorbency of the samples was measured. The samples showed decreased absorbency as compared with that of the corresponding unirradiated material. Since there were no detectable amounts of uv absorbing products formed, it was assumed that loss of absorbency at around lambda max is a measure of the radiation damage to the chromophore in the compounds studied. Plots were constructed using the decrease in optical density at lambda max versus delivered dose. The results indicated increased chromophoric loss with increased solute concentration. Preliminary results obtained with DNA X-irradiated in vitro and in vivo confirmed previous observations that cyclobutyl dimerization is absent in X-irradiated DNA. NSA

N70-31674 Washington Univ., Seattle.
NEUTRON CAPTURE GAMMA-RAY ACTIVATION ANALYSIS
Stewart Matthew Lombard (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-18298

Neutron capture gamma-ray activation analysis is a method of rapid, nondestructive elemental analysis based on the instantaneous decay by gamma ray emission of nuclear excited states produced by the capture of thermal neutrons. The method is applicable to many elements which cannot be determined by conventional neutron activation analysis because they do not produce a radionuclide with a suitable half-life following neutron capture. The apparatus described in this work is designed to optimize analytical sensitivity and accuracy. A filter/collimator located within a vertical beam tube of the University of Washington Nuclear Reactor produces a thermal neutron flux of 1.1 × 10 to the 7th power n/sq cm · sec at the sample with low fast neutron and gamma ray fluxes. A high resolution chopper system modulates the neutron beam and gates the multichannel analyzer, allowing automatic subtraction of background radiation during analysis. Dissert. Abstr.

N70-31729# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
PHOTOPRODUCTION OF NEUTRAL RHO MESONS
H. Alvensleben, U. Becker, William K. Bertram, M. Chen, K. J. Cohen et al Dec. 1969 48 p refs Prepared jointly by Deut. Elektron. Synchrotron and MIT
(DESY-69/50) Avail: AEC Depository Libraries

Results of measurements on the photoproduction of neutral rho mesons are presented. An analysis of 100,000 measured pion pairs on protons in the energy region 2.6 to 6.8 GeV using various assumptions of rho meson production indicates that d sigma/dt (t=0) decreases with increasing energy similar to pion-neutrino scattering. An analysis of 1 million measured pion pairs from 13 complex nuclei in a four dimensional data matrix d sigma/d Sigma dm (A,m,p,t) with dimensions 13, 20, 6, 60 yields precise information on nuclear density distributions determined by rho meson production. For the Wood–Saxon radii R(A) = (1.12 + or − 0.02)A to the 1/3 power fm and, using the vector dominance model, sigma sub rho meson-neutrino = 26.7 + or − 2.0 mb and gamma sq sub rho meson/4 pion = 0.57 + or − 0.10. Author (NSA)

N70-31730# Chicago Univ., Ill. Enrico Fermi Inst.
PCAC: THE DALITZ PAIR PROCESS AND THE 'PRIMAKOFF EFFECT' IN THE PHOTOPRODUCTION OF THE AXIAL-VECTOR MESON ON PROTON
T. H. Chang (Ph.D. Thesis) Mar. 1970 44 p refs
(Contract AT(11-1)-264)
(EFI-70-14; COO-264-540) Avail: CFSTI

PCAC is introduced into the Dalitz pair process and then its consequence is compared with the ordinary quantum electrodynamical approach and Adler's perturbation method in which the triangular diagram is essential for the neutral pion gamma gamma vertex. The Primakoff effect in the photoproduction of the axial-vector meson on proton is calculated explicitly. The coupling strength of the axial-vector-meson gamma gamma vertex is determined from the hyperfine splitting in the hydrogen atom, which is ten times smaller than determined from the neutral pion gamma gamma vertex indirectly. Author (NSA)

N70-31758# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE THEORIE OF TWO NUCLEON TRANSFER REACTIONS [ZUR THEORY VON ZWEINUKLEONENTRANSFERREAKTIONEN]
Peter Froebrich (Ph.D. Thesis) 14 Jan. 1970 71 p refs In GERMAN
Avail: CFSTI

Generalized Green functions are used to develop the necessary equations for the formal scattering theory and the relative S-matrix. The formalism is further extended by encorporating elastic scattering and single particle transfer. The T-matrix for the two particle transfer is obtained by applying a six point function for ground level transfers and higher Green functions for excited levels. The developed T-matrix, which contains the distorted wave Born approximation, gives expressions for effective exchange and optical potentials in the multiple particle theory. An example calculation for neutron-proton pair transfer in the (He3,p) reaction is presented by forming a mathematical model for a j-shell with constant interaction for T=0 and T=1 pairing. Application of the variable wave functions shows an increase for J=0 transfers by a factor of 1,2-3 in comparison with the shell model. It is concluded that n-p correlations in deuteron transfer reactions can become important if such correlations are contained in the participating nuclei. Transl. by G.G.

N70-31770# Brookhaven National Lab., Upton, N.Y.
DETERMINATION OF ULTRAMICRO QUANTITIES OF Ra 226 IN DIFFERENT SUBSTANCES
A. A. Pomanskii et al 1969 8 p refs Transl. into ENGLISH from At. Energ. (USSR), No. 27, 1969 p 36–39
(BNL-tr-327) Avail: CFSTI

A highly sensitive method for the determination of small quantities of Ra-226 in different samples was developed. Rn-222 is extracted from the solutions of these samples in liquids, then purified and detected in a low-background proportional counter. By this system as little as 10 to the −17th power gram Ra-226 per gram of sample can be detected. The contents of Ra-226 in some samples were measured. Author (NSA)

N70-31844 Massachusetts Univ., Amherst.
INVESTIGATION OF THE BETA-DECAY OF THE GROUND STATE OF PROMETHIUM-148
Robert Augustus Amadori (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-18593

The beta decay of the ground state of Pm-148 was investigated by means of the beta-gamma directional correlation of the inner-beta-groups and beta-longitudinal polarization of the outer beta-group. The electron longitudinal polarization of the 2480 KeV beta-group is measured using the Moller scattering method. A relative measurement is performed using P-32 as a standard. The longitudinal polarization was measured at an energy of 800 KeV and found to be (−0.99 + or − 0.08)v/c. The results indicate no deviation from a polarization of −v/c and are in agreement with those for higher energies. Because of the nature of the decay, only three matrix elements contribute. Using the shape factor and

the polarization data along with the corrected ft value, the three matrix elements can be independently determined. Dissert. Abstr.

N70-31866# Mound Lab., Miamisburg, Ohio.
DISPROPORTIONATION OF TETRAVALENT AND PENTAVALENT PLUTONIUM IONS: SOME THEORETICAL CONSIDERATIONS
G. L. Silver 26 Mar. 1970 27 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1717) Avail: CFSTI

Plutonium literature does not satisfactorily include the four common oxidation states of plutonium in discussions of the stoichiometry of the disproportionation of the tetravalent and pentavalent states of this element. A theoretical study of possible consequences of including all common oxidation states of plutonium in the disproportionation reactions was made. The study, based upon available potential and free energy data, indicates that the disproportionation equations can be written with all four species included. The potential behavior of disproportionated plutonium solutions can be predicted with the aid of these new equations. The equations also predict that the hydrogen ion dependence of plutonium disproportionation reactions should not be exactly fourth power at all acidities. Author (NSA)

N70-31867# National Lead Co. of Ohio, Cincinnati. Technical Div.
QUANTITATIVE ALPHA SPECTROMETRIC DETERMINATION OF U 232
H. W. Humphrey and K. M. Fritz Feb. 1970 18 p refs
(Contract AT(30-1)-1156)
(NLCO-1048) Avail: CFSTI

A method was developed for determining the concentration of U-232 in uranium materials to a low limit of 10 ppB on a U-235 basis with a relative precision of + or − 28.2% at the 95% confidence level. The method consists of an ethyl acetate extraction followed by a measurement of the 5.298-MeV (average weighted value) alpha peak of U-232 utilizing a Frisch grid ionization chamber. A mass spectrometric U-235 value is then used to determine the U-232/U-235 weight relationship. Author (NSA)

N70-31893 California Univ., Berkeley.
SEARCH FOR THE DIRECT DECAY MODES K(+) YIELDS MUON(+) + NEUTRINO + GAMMA AND K(+) YIELDS PION(+) + GAMMA + GAMMA
Min Chen (Ph.D. Thesis) 1969 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-18897

The direct decay is experimentally distinguished from ordinary inner bremsstrahlung by a measurement of the angle theta between the direction of the muon and gamma ray emission for events with high energy muons. The direct decay favors the emission of photons in a direction opposite to that of energetic muons while for the inner bremsstrahlung the emission of soft photons at small forward angle prevails. Twenty-seven events were found with muon kinetic energy between 137 and 142 MeV. The search was centered around obtaining direct decay examples where the invariant mass of the two gamma rays is different from that of the neutral pion. Candidates were recognized by the relation of the conversion points of two gamma rays to the momentum of a charged particle. The charged particle was assumed to be a pion. Its momentum was determined from its range in an aluminum plate spark chamber. Dissert. Abstr.

N70-31902# Naval Research Lab., Washington, D.C. Linac Branch.
LINAC OPERATION Interim Report, 1 Jul.−31 Dec. 1969
T. F. Godlove Jan. 1970 25 p refs
(AD-703619; NRL-MR-2094; IR-9) Avail: CFSTI CSCL 20/7

The operation and use of the NRL 60-MeV Electron Linear Accelerator is described for the period 1 July - 31 December 1969. Progress on the research program of the Linac Branch is discussed, including electron scattering, activation analysis, and observations of gamma rays from photonuclear reactions. Use of the linac as a pulsed neutron source continues to expand. Neutron capture measurements of resonances in Yb, Er, and Pd isotopes are described, as are gamma-ray multiplicity measurements on Hf and Nd. Delivery of a 12-kiloword, 16-bit computer and magnetic tape peripheral completes a new data-acquisition system except for various interface electronics either on order or being built. Experiments were performed showing that the linac bremsstrahlung beam could be used to accurately determine the number of warheads in a closed container for potential MIRV ground inspection. Author (TAB)

N70-31921 IIT Research Inst., Chicago, Ill.
STRUCTURE IN TOTAL (n,alpha) CROSS SECTIONS AROUND 14 MeV
Maureen Ann Warnock (Ph.D. Thesis) 1969 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-21939

A total of 635 cross section measurements were made for the Al-27(n,alpha) reaction at about 87 different neutron energies during 19 different ICT irradiations. The first 185 cross section determinations were made by following the beta activity of the Na-24 product. A computer program was written to correlate the relative cross sections obtained from one irradiation to the next. The remainder of the measurements were carried out by observing the gamma-ray acticity of Na-24 under the 1.37 MeV photo-peak. Computer programs were used to determine the amount of activity due to Na-24 under the photo-peak, subtract a background, and to extrapolate the activities back to time zero. The data was corrected for the effects of anisotropy and scattering using correction factors obtained experimentally by measuring the neutron intensity of various angles from the dueteron beam direction with the employment of proton recoil telescopes. Author

N70-31946*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF FIXED-NUCLEI APPROXIMATIONS OF ELECTRON-MOLECULE SCATTERING AND THE ADIABATIC THEORY OF ROTATIONAL EXCITATION
A. Temkin Jun. 1970 37 p refs Submitted for publication
(NASA-TM-X-63955; X-621-70-227) Avail: CFSTI CSCL 20H

A complementary approach to the scattering problem is discussed that replaces the molecule by one in which the nuclei are fixed during the whole scattering process. The fixed nuclei theory provides a reliable and convenient method of calculating the average cross section and, coupled with the adiabatic theory, effectively supersedes rotational close coupling as a method for calculating most aspects of rotational excitation. Author

N70-31959# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
A STUDY OF THE DETAILED VARIATIONS OF NUCLEAR RADII IN THE RANGE 40 < OR = A < OR = 62 BY MEANS OF THE ELASTIC SCATTERING OF 42 MeV ALPHA PARTICLES FROM Ca 40, Ca 42, Ca 44, Ca 48, Ti 46, Ti 48, Ti 50, Cr 52, Fe 54, Fe 56, Ni 58, Ni 60, Ni 62 [ETUDE DES VARIATIONS FINES DU RAYON NUCLEAIRE DANS LA REGION 40 < OR = A < OR = 62 PAR DIFFUSION ELASTIQUE DE PARTICULES ALPHA DE 42 MeV SUR Ca 40, Ca 42, Ca 44, Ca 48, Ti 46, Ti 48, Ti 50, Cr 52, Fe 54, Fe 56, Ni 58, Ni 60, Ni 62]
Bernard Fernandez (Ph.D. Thesis—Paris Univ., 16 Jun. 1969) Mar. 1970 100 p refs In FRENCH; ENGLISH summary Prepared

jointly with Washington Univ., Seattle
(CEA-R-3948) Avail: CFSTI

Angular distributions of 42 MeV alpha particles, elastically scattered from Ca 40, Ca 42, Ca 44, Ca 48, Ti 46, Ti 48, Ti 50, Cr 52, Fe 54, Fe 56, Ni 58, Ni 60, and Ni 62, were measured in the forward region with an absolute accuracy of + or − 0.1 deg and the locations of the minima near 35 deg. The theoretical analysis was performed using: (a) the Fraunhofer model; (b) direct parameterization of the scattering amplitude in terms of 3 parameters, and (c) a standard 4-parameter optical model. Strong absorption radii were deduced from the critical angular moments extracted from the scattering amplitudes. Attempts were made to determine, for the optical model, other types of strong absorption radii which were more characteristic of the scattering than the usual midpoint radius of the potential. In the region where its depth is less than 6 to 7 MeV the optical potential was determined accurately. Author (ESRO)

N70-31995*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TIME HISTORY PLOTS AND COMPUTER MADE MOVIES OF ION-POLAR MOLECULE COLLISIONS OF INTEREST IN MASS SPECTROMETRY
John V. Dugan, Jr. and John L. Magee (Notre Dame Univ.) 1970 17 p refs Presented at Am. Soc. of Mass Spectrometry, San Francisco, 16 – 21 Jun. 1970
(NASA-TM-X-52843) Avail: CFSTI CSCL 18H

Capture cross sections are calculated for ion-polar molecule collisions of interest in mass spectrometry. These cross section predictions are in relatively good agreement with experimental data on reaction cross sections. The collision trajectories have been studied using computer-plotter techniques. The interaction potential consists of a hard-sphere term plus the attractive polarization and ion-dipole terms. Multiple reflections corresponding to formation of long-lived complexes occur off the hard-core barrier at small ion-molecule separations. Multiple-reflection times are 10 to 500 times corresponding values for single reflections. Hindered rotation of the polar targets (suggested by time history plots) is studied by computer-made movies. This technique also offers a convenient visual means for observing the relative motion of the ion-molecule pair. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-30615# Oak Ridge National Lab., Tenn.
EXPLORATORY PLASMADYNAMIC STUDIES OF VORTEX AND COAXIAL FLOW GEOMETRIES EMPLOYING RADIO-FREQUENCY INDUCTION HEATING
J. J. Keyes, Jr. and W. K. Sartory Mar. 1970 33 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2856) Avail: CFSTI

Experiments are described in which the effect of high-energy-density volumetric heating on jet-driven vortex flow of helium and argon were determined. A radio-frequency power source capable of 50-kW output in the range from 0.4 to 4.0 mHz was used to heat argon and helium-argon plasmas inductively at atmospheric pressure to peak temperatures estimated to be between 10,000 to 15,000 K depending on plasma composition. Experiments with 2-in.-diam by 6-in.-long water-cooled copper and quartz vortex tubes have revealed that significant increase in the ratio of tangential velocity to injection velocity above that measured at room temperature is effected when the argon gas is inductively heated to plasma conditions. Exit gas temperatures of up to 7000 K have been measured. Author (NSA)

N70-31058*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IRREGULAR STRUCTURE OF THERMAL ION PLASMA NEAR THE PLASMAPAUSE OBSERVED FROM OGO-3 AND Pc-1 MEASUREMENTS
H. Kikuchi and H. A. Taylor, Jr. 7 Nov. 1969 46 p refs Submitted for publication
(NASA-TM-X-63898; X-621-69-507) Avail: CFSTI CSCL 20I

Direct measurements of thermal ion distributions in the magnetosphere reveal a distinct variability in the position and structure of the plasmapause. The observed variability is generally pronounced in the afternoon-dusk local time sector, and is also observed at other locations during the recovery phase of a magnetic storm. Progressive passes of the OGO-3 satellite have verified an outward expansion or bulge in the dusk-side plasmasphere, accompanied by considerable fine structure, and similar fine structure near the plasmapause outside the dusk region during the recovery phase of a storm. In addition, a correlation with Pc-1 data further supports this evidence of plasma irregularities in the dusk and in the post-storm recovery regions. A limited Pc-1 data sample indicates that these geomagnetic micropulsations may be generated and propagated near the plasmapause. Author

N70-31060# European Space Research Inst., Frascati (Italy).
RADIATION FROM A THETA-PINCH WITH OSCILLATORY DENSITY
T. S. Green Apr. 1970 15 p refs
(ESRIN-IN-84) Avail: CFSTI

Theta-pinch discharges have been used extensively for radiation studies in the far and normal ultraviolet, both for line identification and the determination of excitation rates. Identification of particular ionic species can also be carried out in simple cases (e.g. O2 and C). With more complex ions the identification may be less simple. Measurements of rates of excitation of given levels are possible because, at densities from 10 to the 16th power to 10 to the 17th power per cu cm the excitation times are less than 1 microsec and the collisional depopulation times are long. However, the latter may not always be correct, and also the decay scheme may be complex so that the level being studied may be populated due to cascade from an upper level. The superposition of an oscillation in magnetic fields of the pulsed Theta-pinch, which causes oscillations of density, can cause oscillations in the radiation and can provide a help in the interpretation of the above spectral studies. Author (ESRO)

N70-31196# Transtek Associates, Reading, Mass.
TURBULENT PLASMA HEATING IN DISCHARGES WITH A SKIN CURRENT
L. V. Dubovoi et al Feb. 1970 25 p refs In ENGLISH and RUSSIAN Transl. into ENGLISH of Gos. Kom. po Ispolz At. Energii SSSR, Leningrad report NP-18106 Prepared for Princeton Univ.
(Contract AT(30-1)-1238)
(MATT-Trans-99; NP-18106) Avail: CFSTI

Results of experimental study of turbulent plasma heating effectiveness in rf discharges with skinned current are reported. On the assumption that in the skin layer region ion acoustic instability develops, the calculation scheme of plasma heating effectiveness in such type systems is created, which takes into account the discharge current dissipation in turbulent plasma and transfer phenomena accompanying the energy dissipation of rf fields in a direction perpendicular to the external magnetic field. Applicability of concepts developed in this work to the case of turbulent-plasma heating by single current pulses of short-time duration is discussed. Author (NSA)

N70-31284# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
NUMERICAL CALCULATION OF GROWTH RATES OF MHD

INSTABILITIES OF THE SCREW PINCH [NUMERISCHE BERECHNUNG DER ANWACHSRATEN VON MHD-INSTABILITAETEN AM SCREW-PINCH]

R. Wilhelm Aug. 1969 33 p refs In GERMAN; ENGLISH summary
(IPP-1/100) Avail: CFSTI

The growth rates of MHD-instabilities for a screw-dishcarge in the region above the Kruskal-limit were calculated. In one case the whole z-current flowed through the plasma column and in the other it was assumed that the pitch was constant in the region between the plasma column and the wall. The growth rates of the m = 1 instability were compared for a given relative displacement of the plasma column. It was found that the growth rates in the constant-pitch-model were less than in the vacuum case. Author (ESRO)

N70-31265# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

AN ABSOLUTELY MHD STABLE AXISYMMETRIC CLOSED FIELD LINE EQUILIBRIUM

Ekhard Rebhan Nov. 1969 22 p refs
(IPP-6/81) Avail: CFSTI

The equilibria considered have closed meridional magnetic field lines produced by toroidal currents. Assuming reasonably shaped flux surfaces, equilibria can only be stable if a hard core field is superimposed on the plasma currents. Further stability criteria are given in the general finite beta case and it is shown that as the stable equilibria actually exist. ESRO

N70-31268# European Space Research Inst., Frascati (Italy).

BROADENING OF THE HEII LINE LAMBDA = 4686 A IN A PLASMA

P. Bogen Apr. 1970 8 p refs
(ESRIN-IN-83) Avail: CFSTI

The profile of the He II lambda = 4686 A line was measured in a plasma with an electron density of 5.5 X 10 to the 17th power per cu cm and a temperature of 60,000 K. The measured halfwidth was consistent with that predicted by the Griem and Shen theory. On the far wings the intensity approached the value expected when ions and electrons are treated by the static theory, although the electrons were far outside the static broadening regime. Author (ESRO)

N70-31269# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

DISPERSION RELATION OF AN INHOMOGENEOUS VLASOV PLASMA

R. Croci and R. Saison Nov. 1969 28 p refs
(IPP-6/82) Avail: CFSTI

An integral equation for the electric potential in Laplace-Fourier space was derived for a class of distribution functions leading to density profiles which are everywhere infinitely differentiable. The problem of the stability of the solutions reduced to determining the singularities in the omega-plane of the solutions. A necessary and sufficient condition for the existence of singularities not independent of kappa x was obtained. The problem was greatly simplified in the case of quasi-neutrality. Author (ESRO)

N70-31271# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

PROBE MEASUREMENTS OF THE RADIAL DISTRIBUTIONS OF POTENTIAL, ELECTRIC FIELD, AND CURRENT DENSITY IN A HYDROGEN ARC WITH AN AXIAL MAGNETIC FIELD [SONDENMESSUNGEN DER RADIALEN VERTEILUNGEN VON POTENTIAL, ELEKTRISCHER FELDSTAERKE UND STROMDICHTE IM WASSERSTOFFLICHTBOGEN MIT STARKEM UEBERLAGERTEM MAGNETFELD]

R. Schwenn Dec. 1969 44 p refs In GERMAN; ENGLISH summary
(IPP-3/103) Avail: CFSTI

The radial distributions of potential, electric field, and electric current density in a stationary hydrogen arc and axial magnetic field were measured by shooting various potential probes or induction coil probes across the arc. A temperature profile in good agreement with those from other methods was derived from current density and field strength measurements. ESRO

N70-31285# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

MEASUREMENTS OF THE POTENTIAL AND CURRENT DENSITY DISTRIBUTIONS IN A SIMULATED FARADAY-TYPE MHD GENERATOR WORKING WITH ARGON-POTASSIUM PLASMA [MESSUNGEN DER POTENTIAL- UND STROMDICHTEVERTEILUNGEN IM ARGON-KALIUM-PLASMA EINES SIMULIERTEN FARADAY-MHD-GENERATORS]

J. Burger Dec. 1969 75 p refs In GERMAN; ENGLISH summary
(IPP-3/104) Avail: CFSTI

Potential distributions in a Faraday-type MHD-generator were measured with movable electrostatic probes in the generator duct to provide data on the relevant current distributions. The current lines and also the regions in which the current of the individual electrode pairs flowed were also determined. The measurements were made in a potassium seeded argon plasma with gas temperature 2000 K, gas pressure 1 atm and flow velocities of 55 - 115 m/sec. The maximum magnetic field intensity was 1.5 tesla and the average current density was 0.1 - 1.7 amp/sq cm. ESRO

N70-31385# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

TABLES FOR PRESSURE INCREASE AND THERMAL CONDUCTIVITY IN A CYLINDRICALLY SYMMETRIC HYDROGEN PLASMA IN AN AXIAL MAGNETIC FIELD TAKING INTO ACCOUNT THERMAL FORCES [TABELLEN ZUR DRUCKERHOEHUNG UND WAERMELEITFAEHIGKEIT IN EINEM ZYLINDER SYMMETRISCHEN WASSERSTOFFPLASMA IN AXIALEN MAGNETFELD UNTER BERUECKSICHTIGUNG VON THERMOKRAEFTEN]

J. Reeder and S. Wirtz Oct. 1969 257 p refs In GERMAN; ENGLISH summary
(IPP-3/101) Avail: CFSTI

The pressure increase and thermal conductivity normal to the magnetic field were calculated for a cylindrically symmetrical hydrogen plasma column in an axial magnetic field. The calculation, based on the first and third moments of the Boltzman equations for atoms, ions, and electrons, were carried out using both the Saha and the Korona equations. Numerical results are tabulated for magnetic fields ranging from 1 to 10 tesla, external pressures ranging from 1 to 10,000 N/ sq m and temperatures ranging from 6,000 to 1 million K. Author (ESRO)

N70-31398# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

EXPERIMENTS WITH BERNSTEIN WAVES [EXPERIMENTE MIT BERNSTEINWELLEN]

F. Leuterer Nov. 1969 35 p refs In GERMAN; ENGLISH summary
(IPP-3/102) Avail: CFSTI

Two experiments with Bernstein waves (cyclotron harmonic waves) in plasma are described. The first one was a transmission experiment in which the signal transmitted between two antennas immersed in the plasma was detected with a polar interferometer.

The second one studied the radio-frequency electric field within an inhomogeneous plasma column in which Bernstein wave resonances (Buchsbaum-Hasegawa modes) had been excited by means of an externally applied RF electric field. ESRO

N70-31399*# Scientific Translation Service, Santa Barbara, Calif.
SPECTROANALYTIC CHARACTERISTICS OF PLASMA OBTAINED USING A LASER IN THE REGULAR AND QUASISTATIONARY GENERATION MODES [O SPEKTRALNOANALITICHESKIKH OSOBENNOSTYAKH PLAZMY, POLUCHENNOY S POMOSHOHYU OKG V REGULYARNOM I KUAZISTATSIONARNOM REZHIMAKH GENERATSII]
V. V. Zhukovskiy et al. Washington NASA Jun. 1970 11 p refs Transl. into ENGLISH from Zh. Prik. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 11, no. 1, 1969 p 13–19
(Contract NASw-2035)
(NASA-TT-F-13044) Avail: CFSTI CSCL 20I

A neodymium glass element laser with confocal mirrors was tested with magnesium aluminum, iron, copper, tungsten, lead, and graphite. The specimens were irradiated in the spike and continuous power modes and the resulting spectra were analyzed. Author

N70-31672# Naval Postgraduate School, Monterey, Calif.
THIRTEENTH AFOSR CONTRACTORS' MEETING ON PHYSICAL ENERGETICS: COMPILATION OF RESEARCH SUMMARIES
Fred Schwirzke and Alfred W. Cooper, comps. 15 Apr. 1970 183 p refs Conf. held at Monterey, Calif, 5-7 May 1970
(AD-704096; NPR-61SW0031A) Avail: CFSTI CSCL 18/1

It was the purpose of this conference to facilitate the exchange of latest information on research in non-chemical energy sources, release mechanisms and conversion processes. The topics discussed were: Injection and plasma generation; Turbulence and waves; Confinement and instabilities; Calculations and instrumentation; Low temperature plasmas; and Future plasma applications. TAB

N70-31736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASMA INSTABILITIES AND COMPENSATION OF THE SPACE CHARGE OF AN ION BEAM
M. V. Nezlin 4 Mar. 1970 40 p refs Transl. into ENGLISH from Dokl. Inst. At. Energii (Moscow), no. 277, 1966 p 1–43
(AD-704009; FTD-HT-23-208-69) Avail: CFSTI CSCL 20/9

Intense ion beams in magnetic fields, employed in such work as isotope separation and injection into plasma mirror machines are investigated experimentally to determine the beam intensity levels at which beam instabilities arise. A review of the work in this field is given. Detailed analysis of the most important processes include the discussion of the generation of plasma oscillations in a cold plasma inter penetrated by fast ion beams, the instabilities in the ion source plasma and amplification of oscillation in a cold plasma by ion beam oscillations. The criteria for instability growth, amplification and interaction coupling are discussed and examples quoted. The proposed methods of improved compensation of the space charge of the ion beam are based on the conclusion that three step instability behavior is basic to the system considered by the author. These include reduction in the oscillation amplitude in the ion source, reduction of the coefficient of growth of instability in the ion beam by redesigning the beam optics, and finally, the reduction of secondary plasma oscillations. Author (TAB)

N70-31799*# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
OCCURRENCE AND BEHAVIOR OF CURRENT SPOKES IN MPD ARCS
Robert A. Cochran and James A. Fay Feb. 1970 64 p refs
(Grant NGR-22-009-269)
(NASA-CR-110507; MIT-FML-70-1) Avail: CFSTI CSCL 20I

A pulsed MPD arc was operated to determine experimentally the occurrence of the rotating spoke mode of operation and to investigate voltage characteristics and spoke frequency of the MPD arc. It was found that the single rotating current spoke occurs at intermediate current levels above a critical magnetic field strength. A comparison of the spoke frequency measurements with actuator-disk theory shows that the actuator-disk model gives a satisfactory prediction of the behavior of the spoke frequency until a limiting frequency is reached after which the spoke approaches a constant rotational speed which is the same for all gases. The variation in the electrode voltage was found to obey the correlation of Patrick and Schneiderman when the arc was operated in the diffuse mode at low power levels. In the spoke mode voltages several times this prediction were measured and can be explained in terms of the emf generated by the rotating spoke. Several criteria are suggested which predict the observed spoke-no spoke boundaries. Author

N70-31919*# Maryland Univ., College Park. Inst. for Fluid Dynamics.
MEASURED OPTICAL ABSORPTION COEFFICIENTS FOR URANIUM PLASMAS
M. H. Miller, T. D. Wilkerson, and R. Roig Apr. 1970 51 p refs
(Grant NGR-21-002-167)
(NASA-CR-72661; BN-652) Avail: CFSTI CSCL 20I

Absolute emissivities of uranium plasmas (3000-8800A) were measured using a gas-driven shock tube. Temperatures (7500-12,000 K) and uranium pressures (1/30-1/3 atmos.) approach those anticipated at the hydrogen-uranium interface of proposed gas-core nuclear reactors. At these conditions, U(I), U(II), U(III) is essentially the only spectroscopically active constituent of shock tube test gases composed of 0.2-2.0% UF6 in neon. Absolute emissivities at 5000 A are measured photoelectrically both in emission and in absorption. The variation of emissivity with wavelength was obtained from time-resolved photographic recording. Measured visible emissivities are smaller than theoretical predictions, depending on the plasma's state. Emissivity (and opacity) decrease with increasing temperature slightly more rapidly than theory predicts. The dependence of emissivity on uranium density is an order of magnitude greater than expected theoretically. The data suggest that the continuum is more important than previously supposed. Between 4000-8800 A, emissivity varies with wavelength in essentially the predicted way; however, a predicted surge in ultraviolet (3000-4000 A) emissivities was not observed. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-30614# IIT Research Inst., Chicago, Ill. Dept. of Physics.
THERMAL MEASUREMENTS ON SOLIDS BELOW 1 K Progress Report
Harold Weinstock Feb. 1970 16 p refs
(Contract AT(11-1)-1629)
(COO-1629-17; PR-4) Avail: CFSTI

A summary of research accomplishments is reported and includes studies on: (1) thermal conductivity of cobalt chloride thiourea in zero and externally applied magnetic fields; (2) phonon resonance scattering in CdS containing Co(2+); (3) magnetic field dependence of the basal plane thermal conductivity of pyrolytic

graphite; (4) thermal conductivity of radiation damaged MgO; (5) nuclear specific heat of UO2Rb(NO3)3; and (6) thermal conductivity of superconducting alloys. D.L.G.

N70-30622# Sandia Corp., Albuquerque, N.Mex.
DYNAMIC MECHANICAL BEHAVIOR OF POLYCRYSTALLINE Al2O3
D. E. Munson Jan. 1970 30 p refs Sponsored by AEC
(SC-RR-69-803) Avail: CFSTI

The dynamic stress-strain behavior for high density polycrystalline Al2O3 was determined for deformation conditions of uniaxial strain using explosive loading techniques. The stress-strain behavior is strain rate dependent elastic-plastic with a Hugoniot elastic limit which varies from 70 to 136 kbar with increasing strain rate. Elastic constants determined dynamically are in excellent agreement with ultrasonic and static constants. Analysis of data produces a dynamic hydrostat which may be compared to static data and which indicates a flow stress for Al2O3 of 66 kbar. This flow stress, which is larger than that for static tensile fracture, appears to correspond to the stress necessary to nucleate slip patches in dislocation free Al2O3. Author

N70-30636# Battelle Memorial Inst., Columbus, Ohio.
THEORY OF FERRIMAGNETISM IN INSULATORS Final Report
R. P. Kenan 2 Mar. 1970 7 p refs
(Grant AF-AFOSR-1535-68)
(AD-702817; AFOSR-70-0665-TR) Avail: CFSTI CSCL 20/12

The research carried out under this grant is summarized. The two principal studies have been (1) the development of a general random-phase theory for anisotropic spin systems, and (2) the investigation of a systematic series of truncation schemes for Greens function theories. Author (TAB)

N70-30647# Brown Univ., Providence, R.I. Dept. of Physics.
THEORY OF THE DIAMAGNETIC INTERACTIONS AMONG THE CONDUCTION ELECTRONS IN METALS
S. C. Ying, B. J. Mc Intyre, and J. J. Quinn 1970 32 p refs Supported in part by ARPA and NSF
(AD-702792) Avail: CFSTI CSCL 20/12

There has been considerable interest recently in the effect of the magnetic interactions among the conduction electrons on diamagnetism in metals. The magnetization density wave (MDW) state was first suggested by the study of the wave-number dependent susceptibility. The MDW state has been studied by Azbel and by the present authors (1969). The purpose of this paper is to present a more detailed discussion of the ideas introduced in the previous paper by the present authors (1969) and to investigate the boundary conditions more carefully. The entire calculation is in the spirit of mean field theory (also referred to as molecular field theory). TAB

N70-30689# Brookhaven National Lab., Upton, N.Y.
BARYON SPECTROSCOPY
N. P. Samios [1969] 33 p refs Presented at Conf. on Fundamental Interactions at High Energy, Coral Gables, Fla., 21-23 Jan. 1970 Sponsored by AEC
(BNL-14423; CONF-700107-2) Avail: CFSTI

A filtered version of the experimental situation concerning the baryon mass spectrum is presented. Included in the discussion are: (1) systematics of baryon states with spin parities and decay ratios, (2) a brief description of some interesting results concerning several low mass N and sigma resonances, and (3) a review of the I = 0, 1; Y = 2 situation. Author

N70-30793*# Radio Corp. of America, Princeton, N.J.
STUDY OF TRANSITION TEMPERATURES IN SUPERCONDUCTORS Final Report, 11 Mar. 1968-10 Mar. 1970
L. J. Vieland and R. W. Cohen 10 Mar. 1970 132 p refs
(Contract NAS8-21384)
(NASA-CR-110432) Avail: CFSTI CSCL 20C

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N70-30794*# Radio Corp. of America, Princeton, N.J.
[INTRODUCTION, MEASUREMENTS, MATERIALS, SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS]
In its Study of Transition Temp. in Superconductors 10 Mar. 1970 p 1-25 (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

Highlights of the research, types of measurements, and materials are described briefly. The measurements include X-ray lattice transformation and Debye-Waller determinstions in single crystal Nb3Sn, and specific heat studies. Doped Nb3Sn and RF sputtering on beta-W superconductors are investigated with respect to maximizing the high superconducting transition temperatures. N.E.N.

N70-30795*# Radio Corp. of America, Princeton, N.J.
CHARACTERISTIC PARAMETERS OF beta-N SUPERCONDUCTORS
G. D. Cody, R. W. Cohen, and L. J. Vieland *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 34-40 refs Presented at 11th Intern. Conf. on Low Temp. Phys., St. Andrews, Scot., 1968 Submitted for publication (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

The band model of the electronic density of states previously developed is applied to the tetragonal state using the parameters obtained from the cubic state data. The magnetic susceptibility,

specific eat, elastic constants, and tetragonal distortion are calculated and compared with experimental data. The agreement between theory and experiment is, in some cases, excellent. However, certain discrepancies suggest that the transformed state cannot be described solely by a tetragonal strain imposed on the cubic-state model. Author

N70-30797*# Radio Corp. of America, Princeton, N.J.
ELASTIC MODULI OF SINGLE-CRYSTAL Nb3Sn
W. Rehwald *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 41-54 refs Submitted in part for publication (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

The temperature behavior of the elastic properties of single crystal niobium stannide changes considerably after annealing and making the crystal visibly transforming (by means of X-rays). From all the elastic moduli, determined by sound velocity measurements in a cubic (110) direction, a transformation temperature of 49 + or - 0.5 K is derived which is in reasonable agreement with structure observed in the temperature dependence of the magnetic susceptibility, but which disagrees with the temperature of 43 K given by others for the structure transformation observed by X-rays. The measured data of C11 and C12 fit well into the theory based on the fact of a jump in the electronic density of states near the Fermi level and the interaction of such a band configuration with elastic strains. The shear modulus C44, however, although monotonically decreasing toward low temperatures, does not fit quantitatively into the theory. Author

N70-30798*# Radio Corp. of America, Princeton, N.J.
SPECIFIC HEAT AND THE LATTICE TRANSFORMATION IN Nb3Sn
L. J. Vieland and A. W. Wicklund *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 55-59 refs Submitted for publication (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

The specific heat of several samples of niobium stannide was measured over the range 25 to 80 K, using the heat pulse technique in a calorimeter of conventional design. Temperature was measured with a Pt resistance thermometer. The train near the transformation is calculated, and the strain and temperature dependence of the strain are in good agreement with X-ray data. Using data from sound velocity measurements, the deformation potential is found to be 4.1 eV. The tetragonality is obtained and is in remarkable agreement with the X-ray value. Author

N70-30799*# Radio Corp. of America, Princeton, N.J.
EFFECT OF UNIAXIAL STRESS ON THE SUPERCONDUCTING TRANSITION TEMPERATURE OF MONOCRYSTALLINE Nb3Sn
J. P. Mc Evoy *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 60-67 refs Presented at Conf. on Sci. of Superconductivity Stanford, Calif., 1969 Submitted for publication (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

Experimental results for the shift in the superconducting transition temperature under uniaxial stress are compared to the predictions of the density of states model. The basic experimental problem was to determine the transition temperature of a specimen which is 4 mm in height and 10 sq mm in area while squeezing it on two flat faces. The specimen was mechanically polished, nickel-plated, and indium-soldered between copper foils before being inserted between two polished-pyrex rods which transmit the applied stress. Experimental results are given for samples cooled through the tetragonal transition temperature under zero-applied stress, and samples heated above that temprature under applied stress. Author

N70-30800*# Radio Corp. of America, Princeton, N.J.
SUPERCONDUCTIVITY AND THE DENSITY OF STATES MODEL FOR BETA-TUNGSTEN COMPOUNDS
R. W. Cohen, G. D. Cody, and L. J. Vieland *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 68-81 refs Presented at NBS 3rd Mater. Res. Symp. on Electron Density of States, Gaithersburg, Md., Nov. 1969 Submitted for publication
Avail: CFSTI CSCL 20C

The important aspects of the electronic band-structure model for beta-tungsten superconductors are described. Expressions for the superconducting transition temperatures and the effective electron-electron coupling constant are derived and the magnitude of the coupling constant is related to the condition for the existence of the lattice transformation from the high temperature cubic to the low temperature tetragonal phase. The effect of the tetragonal transformation of the transition temperatures of V3Si and Nb3Sn is discussed and compared to the results of previous work. It is concluded that a simple electronic density of states model can account for many properties of the normal tetragonal and cubic phases and their high transition temperatures. Author

N70-30801*# Radio Corp. of America, Princeton, N.J.
THE SYSTEM Nb3Sn(1-x)Sb(x) AND THE DENSITY OF STATES MODEL FOR Nb3Sn
L. J. Vieland *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 82-90 refs Submitted for publication
Avail: CFSTI CSCL 20C

A theoretical model and experimental results are compared for the Nb3Sn-Nb3Sb pseudo-binary system. The parameters of the square-band density of states model are identified as the d-band density of states in the cubic state, the deformation potential relating the shift in the band edge with uniaxial strain, and the distance from the Fermi level at 0 K to the near band edge. The samples were prepared by cold pressing powders into pellets and sintering. It was found that the relationship between the distance from the Fermi level to the near band edge and x predicted on the basis of the rigid-band model is not borne out by experimental data. The sign and magnitude of the spontaneous strain below the martensitic transformation temperature, and the superconducting transition temperature dependence on x are discussed. N.E.N.

N70-30802# Radio Corp. of America, Princeton, N.J.
RF-SPUTTERED FILMS OF beta-TUNGSTEN STRUCTURE COMPOUNDS
J. J. Hanak, J. I. Gittleman, J. P. Pellicane, and S. Bozowski *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 91-101 refs Submitted for publication (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

Continuous composition ranges of several binary systems were synthesized, and, by measuring the transition temperature at close composition intervals, the effectiveness of the approach in optimizing the superconducting properties of the materials was observed. A technique of RF cosputtering of binary intermetallic systems from elemental targets was used in depositing films with continuous compositions up to 70 at. % wide. Films deposited on cold substrates were subsequently annealed to yield superconducting compounds. The beta-tungsten phases were readily obtained judging from the transition temperature results and, in the case of Nb3Au and Nb3Pt, also on the X-ray results. Transition temperatures were the same as, or within about one degree of, the highest temperature reported for bulk materials. This approach proved capable of obtaining metastable compositions and controlled compositions. Author

N70-30803*# Radio Corp. of America, Princeton, N.J.
SOLUTION GROWTH OF Nb3Sn FROM LIQUID TIN
J. J. Hanak and D. E. Johnson *In its* Study of Transition Temp.

in Superconductors 10 Mar. 1970 p 102–111 refs (See N70-30793 16-26)
AVail: CFSTI CSCL 20C

A method for the growth of large single crystals of superconducting Nb3Sn is reported. The solution growth takes place readily at high temperatures. The transport occurs from higher to lower temperatures. Three factors were found to be unfavorable to the growth of large gains: free entrapped tin, crucible contaminant NbC, and cavities arising from the difference in molar volumes of the reacting elements Nb and Sn and the compound Nb3Sn. Free tin can be eliminated either by higher growth temperature or by repeated zone recrystallization; the same factors lead to the growth of larger Nb3Sn grains. Increased temperature, however, favors contamination by the graphite crucible. The use of Nb crucible presents leakage problems as well as cavity formation. Author

N70-30804*# Radio Corp. of America, Princeton, N.J.
ELECTRICAL TRANSPORT PROPERTIES OF Nb3Sn IN THE NORMAL STATE
G. Gunsalus *In its* Study of Transition Temp. in Superconductors 10 Mar. 1970 p 112–118 ref (See N70-30793 16-26)
Avail: CFSTI CSCL 20C

Thermopower, resistivity, and Hall measurements were made on a vapor-transported polycrystalline sample deposited on a steatite substrate and on two single crystal samples, one annealed and one unannealed. Graphs are given of the thermopower, resistivity, and differential resistivity as functions of temperature. The Hall data indicate hole conduction in corroboration with the thermopower measurements. N.E.N.

N70-30931# Hughes Research Labs., Malibu, Calif.
SELECTIVE DOPING FOR PIEZOELECTRIC CRYSTALS BY ION IMPLANTATION Technical Report, 1 Jul.–31 Dec. 1969
G. A. Shifrin, D. M. Jamba, W. R. Jones, O. J. Marsh, and M. T. Wauk 31 Dec. 1969 40 p refs
(Contract N00014-69-C-0171)
(AD-702778; TR-2) Avail: CFSTI CSCL 20/12

The feasibility of creating n-type conducting regions in piezoelectric crystals by ion implantation is being investigated. Experimental studies have been performed with crystals of CdS, ZnO, and GaAs and dopant ions of H, B, F, Al, Cl, and Ga. To date, ZnO, CdS, and GaAs have been doped by ion implantation. The ZnO work is being extended to include high resistivity Li-doped material. Semi-insulating GaAs was doped p-type by Cd(+) implantation; S(+) implantation will be used to produce the desired n-type conduction. Acoustic wave propagation and transducer interaction calculations are reported for both ZnO and GaAs. Preliminary calculations for the monolithic amplifier concept in GaAs are reported. A computer program has been developed which calculates the attenuation in the amplification for parallel acoustic propagation and applied electric field. Preliminary results for acoustic monolithic amplifier operation characteristics are reported for both ZnO and GaAs; large gains result for ZnO. Author (TAB)

N70-30936# Cornell Univ., Ithaca, N.Y.
STUDIES OF THE ELECTRON SYSTEM IN METALS AND OF THE NATURE OF THE TRANSITION TO THE METALLIC STATE Final Report, 1 Oct. 1965–30 Sep. 1968
Donald F. Holcomb 1970 8 p refs
(Contract DA-31-124-ARO(D)-407)
(AD-702996; AROD-6028-11-P) Avail: CFSTI CSCL 20/12

The report briefly summarizes a research project which was concerned with two related but distinct topics. The first topic, the electron system in metals, centered upon the alkali metals and their alloys. The second dealt with the nature of the transition, from insulator to metal, of a heavily-doped semiconductor, as a function of impurity concentration. Author (TAB)

N70-31039*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.
DIFFUSION OF SMALL ANGLE X-RAYS TO STUDY IRRADIATION OF MUSCOVITE MICA BY ARGON IONS [ETUDE PAR DIFFUSION DES RAYONS X AUX PETITS ANGLES DE MICA MUSCOVITE IRRADIE PAR DES IONS D'ARGON]
M. Lambert (CNRS, Orsay, France. Lab. de Phys. Des Solides), A. M. Levelut (CNRS, Orsay, France. Lab. de Phys. des Solides), M. Maurette, and H. Heckman (California University, Berkeley) May 1969 19 p refs In FRENCH
(Contract NAS9-8165)
(NASA-CR-110437; SPP-18) CSCL 20L

The method of diffusion of small angles of X-rays to study the damage produced in samples irradiated by argon ions in energy ranges between 1.2 and 10.2 MeV/amu is considered. Particular emphasis is placed on the existence of a discontinuity in the diffusion curves when ion energies decrease below the critical value corresponding to the recording limit of the revealable traces by chemical attack. The evolution of the diffusion curves are also studied with chemical attack and annealing. Transl. by J.M.C.

N70-31044# Harry Diamond Labs., Washington, D.C.
COMPUTATION OF AVALANCHE AND SPACE-CHARGE EFFECTS IN SEMICONDUCTORS AND GASES
Howard M. Bloom Nov. 1969 72 p refs
(AD-700978; HDL-TM-69-35) Avail: CFSTI CSCL 20/3

The report describes the FORTRAN IV program written to compute the behavior of electron and hole (ion) currents in a semiconductor or gas. The behavior is described using the continuity equations (with the effects of electron and hole ionization and their recombination rate) and Maxwells electrostatic equation. The partial differential equations are solved using a parallel method with first-order differencing, and the integrals are numerically evaluated using the trapezoidal rule. The program is designed for use on the IBM 7094 digital computer. The program results compare favorably with experimental work. Author (TAB)

N70-31089# Michigan State Univ., East Lansing. Dept. of Metallurgy, Mechanics and Materials Science.
THEORY OF THE PRE-EXPONENTIAL FACTOR IN ORGANIC SEMICONDUCTORS
Gabor Kemeny and Barnett Rosenberg [1969] 13 p refs
(Contract AT(11-1)-1714)
(COO-1714-6) Avail: CFSTI

Tunnelling through intermolecular barriers from activated energy levels of molecules is postulated to be the conduction mechanism in some organic semiconductors. The compensation rule follows immediately from this model. The relationship between the characteristic temperature on one hand, and the barrier shape, height, width and the effective mass of the electrons on the other, is established. It is shown that the triangular barrier assumption gives a reasonable agreement with experiment, in contrast with the square barrier. Estimates of the barrier height, width and effective mass are given. Author

N70-31159# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
AN IDEALIZED MODEL OF A SUPERCONDUCTOR [UN MODELO IDEALIZADO DE UNA SUPER CORRIENTE]
Guido Beck (Centro Atomico Bariloche) 1969 16 p In SPANISH
(CNEA-233) Avail: CFSTI

By means of a simple model the principal qualitative properties of a current traveling in a superconducting material are obtained. Results compare favorably with experimental results. Transl. by F.O.S.

N70-31171# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
REVIEW OF THE BEHAVIOUR OF IRRADIATED TRANSISTORS AND INTEGRATED CIRCUITS UNDER IRRADIATION [SYNTHESE SUR LE COMPORTEMENT DES TRANSISTORS ET DES CIRCUITS INTEGRES VIS-A-VIS DES RAYONNEMENTS]
Jean-Claude Decuyper Mar. 1970 42 p refs In FRENCH; ENGLISH summary
(CEA-BIB-166) Avail: CFSTI

The reliability of irradiated electronic systems are reviewed. The report covers radiation effects on semiconductor materials, diodes, transistors, FET and MOS devices, and integrated circuits, particularly integrated logic modules. A bibliography of 66 items is appended. Author (ESRO)

N70-31179# Bureau of Mines, College Park, Md. Metallurgy Research Center.
THE RANGE IN METALS AND METAL OXIDE SYSTEMS OF HEAVY IONS IN THE ENERGY RANGE 60 TO 400 keV
B. D. Sartwell, P. B. Needham, Jr. and D. Danforth (Maryland Univ., College Park) Jul. 1970 22 p refs
(BM-RI-7416) Avail: Issuing Activity

Utilizing a theory for determining the range of low-energy ions in solids, the ranges of H, He, C, N, O, and Ar ions in Al2O3, Al, Fe2O3, Fe3O4, CuO, Cu2O, Fe, Cu, Sn, and W were calculated for the energy range 60 to 400 keV using a computer program written in BASIC. The range, presented in graphical form, is given in both micrograms/sq cm and angstroms. In addition, heavy ion ranges were calculated for comparison with published experimental values. For ions with $Z > 5$, the discrepancy between the calculated values and published experimental values generally ranged from 2 to 40 percent; the largest deviations were probably due to experimental error. Author

N70-31194# Scientific Translation Service, Ann Arbor, Mich.
THERMOLUMINESCENCE CHARACTERISTICS OF VARIOUS LITHIUM FLUORIDE CRYSTALS IRRADIATED IN A REACTOR
A. F. Lyushina et al Mar. 1970 7 p refs Transl. into ENGLISH from Latvijas PSR Zinatnu Akad. Vestis, Fiz. un Tehn. Zinatnu Ser. (Riga), no. 5, 1968 p 36-39 Transl. for Argonne Natl. Lab.
(ANL-Trans-813) Avail: CFSTI

A study was made of the thermoluminescence characteristics of various lithium fluoride crystals exposed to a radiation dose of up to 5 × 10 to the 16th power n/sq cm in a vertical beam hole. The possibility of broadening the range of dosimetry by the use of thermoluminescence of LiF crystals is discussed. Author (NSA)

N70-31204# Oak Ridge National Lab., Tenn. Chemistry Div.
TEMPERATURE DEPENDENCE OF FAST PROTON CHANNELING IN Si SINGLE CRYSTALS
B. A. Kononov et al [1970] 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 12, no. 7, 1969 p 131-132
(ORNL-tr-2279) Avail: CFSTI

The effects of temperature on the channeling were investigated for Si single crystals of 80-micron thickness and aligned with the (110) axis coinciding with the incident proton beam. The energy distribution of the protons and the fraction of channeled protons both show that the channeling drops as the temperature increases, practically disappearing at 800 K. The temperature dependence is proposed to be due to increased probability of Rutherford scattering. NSA

N70-31240# Brookhaven National Lab., Upton, N.Y.
Si(Li) COAXIAL DETECTORS
H. W. Kraner, C. A. Boulin, and S. Wagner [1969] 12 p refs Presented at 12th Scintillation and Semiconductor Counter Symp., Washington, D.C. Sponsored by AEC
(BNL-14168-R; CONF-700301-3) Avail: CFSTI

Lithium drifted silicon coaxial detectors have been fabricated from 19 mm diameter material with volumes up to 5 cu cm. The double escape peak is observed for gamma rays interacting by pair production. Resolutions of 5 keV and approximately 10 keV have been observed for incident gamma rays of 2.62 and 7.64 MeV. Slices, 2 to 3 mm thick, have been taken from such coaxial detectors and used as low capacity, high resolution X-ray detectors. A FWHM of 300 eV has been obtained at 6.4 keV using a detector with an active area slightly greater than 200 square millimeter. Author (NSA)

N70-31246# International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center.
PHOTOCONDUCTIVITY IN DISORDERED NICKEL-OXIDE FILMS
R. Tsu, L. Esaki, and R. Ludeke Durham, N.C. AROD 13 Aug. 1969 6 p refs
(Contract DAHC04-69-C-0069)
(AD-704238; AROD-8511-1-P) Avail: CFSTI CSCL 20/12

Photoconductivity measurements in the infrared and visible spectral regions have been made on disordered NiO films. The result shows a prominent peak at the energy of 0.23 eV, coinciding with the one in the infrared absorption, which is believed to be a spin-excited state due to the antiferromagnetic ordering. A model is proposed to explain the observation. Author (TAB)

N70-31250# Saint Mary's Coll., Winona, Minn.
EXPERIMENTAL STUDY OF THE SURFACE STRUCTURE AND ELECTRONIC PROPERTIES OF SINGLE CRYSTAL MOLYBDENUM AND TUNGSTEN RIBBONS Final Report, 1 Nov. 1964-31 Oct. 1969
Donald R. Morgan 12 Jan. 1970 37 p refs
(Contract AT(11-1)-1417)
(COO-1417-4) Avail: CFSTI

Techniques were developed for producing thin single-crystal ribbons of W and Mo, with various amounts of surface disorder. A system was developed for both (LEED) low-energy electron diffraction and Auger studies, and some Auger spectra are given for both Mo and W single crystals. Thermionic emission measurements were made using the retarding-potential method, but the results do not agree with theory. The LEED and Auger results could not be correlated with the thermionic emission constants. NSA

N70-31341# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
FINITE AMPLITUDE WAVE PROPAGATION IN SOLIDS Final Report, 1 Jan. 1964-31 Jan. 1969
James F. Bell Mar. 1970 37 p
(Contract DA-31-124-ARO(D)-154; Grant DA-ORD-31-124-68)
(AD-704367; AROD-2573-6-E) Avail: CFSTI CSCL 20/2

The purpose of this final report is to trace the main threads of thought and to record the major accomplishments which relate to the dynamic and quasi-static plasticity research for the nearly a decade in which the Army Research Office grant and contract made these studies possible. The result of this systematic experimental program provides the fundamental basis for an approach to a theory of plasticity of metals based upon a generalized, parabolic, linearly temperature - dependent constitutive equation which is now well established as applicable to the tension, compression, torsion, mixed tension and torsion, and two-dimensional compression of a very large number of metals over the entire temperature scale and independent of strain rate. Author (TAB)

N70-31349# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
SOLID STATE PHYSICS: MAGNETIC PHENOMENA

Progress Report, 1 Jan. – 31 Dec. 1969
R. Bowers and R. H. Silsbee 31 Dec. 1969 13 p refs
(Contract AT(30-1)-2150)
(NYO-2150-56) Avail: CFSTI

The properties of defects, such as molecular impurities, which show an orientational degeneracy and at least some orientational freedom at low temperatures are discussed. Three projects of this class have been completed and three additional experiments are in progress. The other area of investigation is spin resonance in metals using the transmission technique. In this problem, the effort has been in improved instrumentation. Author

N70-31383# Technische Hochschule Munchen (West Germany).
TRANSITION METAL COMPLEXES WITH ABNORMAL MAGNETIC PROPERTIES [UEBERGANGSMETALLKOMPLEXE MIT ANOMALEN MAGNETISCHEN EIGENSCHAFTEN]
Guido Bell (Ph.D. Thesis) 1970 58 p refs In GERMAN
Avail: CFSTI

Paramagnetic planar transition metal complexes with an electronic structure and steric order in their crystal lattices are conducive to one dimensional metallic, respectively, antiferromagnetic properties. Especially promising seem to be d7-configurations of quadratic complexes with strong ligands. Emphasis is placed on the synthesis of stable six-times coordinated bis-cobalt(11) compounds. Magnetic measurements on bis-2-(2-pyridyl)-thiazolato-iron(11) crystals confirmed the participation of triplets; the magnetic moment remained between 80 deg Kelvin and 20 deg Kelvin almost constant but declined rapidly below 20 deg Kelvin. Transl. by G.G.

N70-31386# Purdue Univ., Lafayette, Ind. Dept. of Physics.
BASIC RADIATION DAMAGE STUDIES. Technical Progress Report, 15 Dec. 1968 – 15 Dec. 1969
30 Dec. 1969 5 p
(Contract AT(11-1)-125)
(COO-125-55) Avail: CFSTI

Research on electron irradiation of Si and Ge at low temperatures is reported. The effects of a 10 K irradiation on the A centers produced in Si by electron irradiation at 80 K are studied. Impurity and annealing effects in n- and p-type Ge are being studied. Author (NSA)

N70-31391 Paris Univ. (France). Lab. de Chimie Physique.
STUDY OF THE BAND STRUCTURE OF SOME METALS AND OXIDES USING CRYSTAL SPECTROSCOPY [ETUDES DE LA STRUCTURE DE BANDES DE QUELQUES METAUX ET OXYDES PAR SPECTROSCOPIE CRISTALLINE]
Y. Cauchois, C. Bonnelle, C. Senemaud, and R. C. Karnatak 1968 13 p refs In FRENCH Presented at the Intern. Symp. on X-ray Spectra and Electron. Struct. of Substances, Kiev, Sep. 1968
Avail: Issuing Activity

X-ray spectroscopic measurements of magnesium and magnesium oxide are presented and the band spectra discussed. Experimental results are compared with theoretical computations and it is shown that the emission band of the metal is strongly dependent on the excitation mode. Further research was done with elements and also the rare earths listed at the end of the periodic table. ESRO

N70-31410# Minnesota Univ., Minneapolis. School of Mineral and Metallurgical Engineering.
AN 'IN-SITU' ELECTRON MICROSCOPE INVESTIGATION OF THE NUCLEATION AND GROWTH OF SPUTTERED THIN FILMS Annual Technical Progress Report
Thos. E. Hutchinson and Dudley Sherman 29 Jan. 1970 19 p ref
(Contract AT(11-1)-1970)
(COO-1790-2; ATPR-2) Avail: CFSTI

Progress toward the completion of construction of apparatus, and testing of the apparatus and determination of the initial data of the nucleation and growth of sputtered copper on amorphous carbon substrates are reported. It was demonstrated that the technique of in situ sputtering by inert gas ion bombardment of targets inside the electron microscope is feasible. Data were obtained on the nucleation and growth characteristics of sputtered copper formed at room temperature and 350 C on amorphous carbon. The data indicate activated state nucleation as well as nonactivated state nucleation. Initial nuclei show strong preferred orientation perpendicular to the substrate, whereas nuclei composing a five monolayer film demonstrator random orientation. Author

N70-31454# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
ENERGY-LEVEL SCHEME FOR Nd(3+) IN LiYF4
D. Sengupta and J. O. Artman [1969] 11 p refs Sponsored in part by AEC
(NYO-4075-5) Avail: CFSTI

Crystal-field parameters appropriate for S4 symmetry were fit to existing data on the 4I sub (9/2) and 4I sub (11/2) sublevel splittings of LiYF4:Nd(3+). Intermediate coupling wavefunctions obtained previously from fits to the CaWO4:Nd(3+) spectrum were used. Although ground state EPR data were not available in this system, the symmetries of the levels were uniquely assignable from group theoretical considerations and the available polarization data. We calculate ground-state g sub 11 and g sub 1 values of 0.483 and 2.571, respectively. The crystal-field parameters found here are compared with those of CaWO4:Nd(3+) and those of the "mirror" ion Er(3+) in LiYF4:Er(3+). We conclude that simple geometrical considerations as to the algebraic signs of the crystal-field components in these systems may be misleading. Author (NSA)

N70-31499# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
STUDIES ON NEUTRON MONOCHROMATOR CRYSTALS HAVING A LATTICE SPACING GRADIENT. PART 1 [STUDIO DI CRISTALLI MONOCROMATORI PER NEUTRONI AVENTI UN GRADIENTE DELLA DISTANZA RETICOLARE. 1]
F. Rustichelli 1970 33 p refs In ITALIAN; ENGLISH summary
(EUR-4414-i) Avail: CFSTI

A theoretical analysis of the utilizations as neutron monochromators of crystals with a gradient of lattice spacing is given. The possibility of utilizing such crystals in composite monochromator systems is investigated. Finally the techniques used to produce crystals with a gradient of the lattice spacing and the first experimental results are described. Author

N70-31515# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
THEORY OF s-d EXCHANGE INTERACTION IN DILUTE MAGNETIC ALLOYS
A. Madhukar and C. C. Tsuei Apr. 1970 4 p refs
(Contract AT(04-3)-822)
(CALT-822-2) Avail: CFSTI

The S-matrix formalism is used to treat the problem of scatting of conduction electrons by localized magnetic moments in dilute magnetic alloys on the basis of the s-d exchange model. A new technique is used to obtain exact solutions for the scattering amplitudes within the approximation of one particle intermediate states. Unitarity is satisfied. Results for phase shifts, critical temperature for the occurrence of quasi bound state, energy width of such state and the spin polarization of the conduction electrons are given and compared with earlier results obtained by different theoretical techniques. Author (NSA)

N70-31550# Oregon Univ., Eugene. Dept. of Physics.
MICROWAVE AND OPTICAL PROPERTIES OF CRYSTALS Final Report
James C. Kemp 4 Feb. 1970 8 p refs
(Grant AF-AFOSR-1474-68)
(AD-704149; AFOSR-70-0283TR) Avail: CFSTI CSCL 20/12

The area of work during the period reported was in the characterization by magneto-optical methods of the oxygen-vacancy centers in MgO and CaO. The most important result was a detailed Faraday-rotation study of the MgO F band, at 4.9 e.v. An excited-state spin-orbit parameter of -12 reciprocal cm. was established. The relationship of the almost coincident F sup 1 band to the F band was clarified. Additional Faraday-rotation experiments were completed on the trigonal R-like centers in MgO, and on the CaO F band. An additional project was a detailed experimental and theoretical investigation of the phonon structure of the CaO F band, both in emission and absorption. Author (TAB)

N70-31565# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
LATTICE SPACINGS AND MAGNETIC SUSCEPTIBILITIES OF Pd-La, Pd-Ce, AND Pd-Pr ALLOYS
J. D. Speight Jan. 1970 12 p refs
(Contract AT(04-3)-221)
(CALT-221-83) Avail: CFSTI

Results of measurements, using a null-coil pendulum magnetometer, as function of the applied field at 2.45 to 8.4 kOe at several temperatures from 0 to 300 K are presented. NSA

N70-31566# Missouri Univ., Rolla. Space Sciences Research Center.
NUCLEAR RADIATION EFFECTS ON SILICON p-n JUNCTIONS
Charles A. Goben Feb. 1970 26 p refs
(Contract AT(11-1)-1624)
(COO-1624-24) Avail: CFSTI

The dependence of neutron-induced space-region recombination on the electric field strength present in the junction during irradiation has been determined. Surface effects of ionizing radiation have been studied and a scheme for predicting the surface degradation of matched devices has been implemented. The junction capacitance variation with neutron fluence and gamma radiation has been determined. A technique has been developed for determining the net impurity profiles of both neutron irradiated (or gold-doped) and unirradiated devices. One result of this has been the discovery that the out-diffusion of the substrate (or buried layer) is non-negligible and has a significant effect on both the base region and collector junction parameters. A discrete, deterministic mathematical model has been developed for the base region of semiconductor transistors which accounts for both the effects of recombination in the neutral base region and the drift field for graded base devices. Author

N70-31614# Technische Hochschule Munchen (West Germany).
INTERPRETATION OF HALL MOBILITY MEASUREMENTS ON THINLY EVAPORATED SEMICONDUCTOR LAYERS [DEUTUNG VON HALL-BEWEGLICHKEITSMESSUNGEN AN DUENNEN AUFGEDAMPFTEN HALBLEITERSCHICHTEN]
Klaus Muecke (Ph.D. Thesis) 1969 28 p refs In GERMAN
Avail: CFSTI

Evaluated are Hall-mobility measurements on thinly absorbed cadmium sulfide-, germanium-, indium antimonide-, and indium arsenide layers. Dependence of charge carrier mobility on the temperature and layer thickness was used to obtain information on the effects of the scattering mechanisms which determine the degree of mobility. It is shown in three scattering processes on epitactic germanium layers that surface-, impurity-, and transfer line scattering can be disregarded at a temperature region of about 400 degree Kelvin; the scattering mobility at this temperature is determined by the scattering from grain boundaries, by lattice vibrations, and by the possible scattering of carriers from each other. Transl. by G.G.

N70-31645*# Westinghouse Electric Corp., Elmira, N.Y. Electronic Tube Div.
SOLID STATE RADIOGRAPHIC IMAGE AMPLIFIERS, PART B Final Report, 1 Jun. 1968 - 30 Nov. 1969
Zoltan Szepesi Nov. 1969 66 p refs
(Contract NAS8-21206)
(NASA-CR-61328) Avail: CFSTI CSCL 20L

The developed solid state image amplifiers are intended as equivalent or improved replacements for fluoroscopic screens and X-ray film used in radiographic evaluations of space vehicle components and structures. Non-storage type radiographic amplifiers similar to fluorescopic screens were built with improved sensitivity and contrast. A simple photoconductor-electroluminescent (PC-EL) type radiographic storage amplifier was developed with high resolution (higher than 300 line/inch), long image storage (5 minutes to 1 hour) and medium radiation input sensitivity (1 rontgen input for suitable image). Light sensitive storage amplifiers were developed as potential replacements for X-Y type area scan-recorders, when used with a high-intensity point light source input. A simple PC-EL construction was developed with an ASA sensitivity of 01, and a cascaded construction with more than ten times higher sensitivity but with lower resolution. Compact power supplies were also built for these image amplifiers. Author

N70-31655 Princeton Univ., N.J.
PROTON MAGNETIC RESONANCE, KINETICS OF LIGAND EXCHANGE AND SINGLE CRYSTAL X-RAY CRYSTALLOGRAPHY OF SOME PARAMAGNETIC COMPLEXES
Louis H. Pignolet (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-18181

The kinetics of exchange of ligand, L, in pseudo-tetrahedral complexes of the type ML sub 2 X sub 2 (where M = Co, Ni; X = Cl, Br, I; and L = triphenylphosphine, tri-p-tolyphosphine, or n-butyldiphenylphosphine) with excess phosphine was studied in deuteriochloroform solutions. Kinetic parameters for the exchange between -60 deg and 60 deg were obtained by proton magnetic resonance using shift and line-width techniques. The ligand exchange follows second order kinetics with the nickel complexes being more labile than their cobalt analogs. The lability of a particular series increases slightly in the order I < Br < Cl. The new dihalobis(n-butyldiphenylphosphine) cobalt complexes have kinetic parameters for ligand exchange similar to those of the triarylphosphines. The structure, spectral and magnetic properties, proton magnetic resonance spectra, and ligand-exchange kinetics were determined for the pseudo-tetrahedral complexes of the type M(TAP) sub 2 X sub 2 where TAP is triarylphosphine, M is Fe and X is a halogen. Dissert. Abstr.

N70-31665# Baylor Univ., Waco, Tex.
CRYSTAL STRUCTURE AND MORPHOLOGY OF HYDROUS OXIDES AND HYDROXIDES IN THE LANTHANIDE AND ACTINIDE SERIES Progress Report
W. O. Milligan Feb. 1970 33 p refs
(Contract AT(40-1)-3955)
(ORO-3955-1) Avail: CFSTI

X-ray diffraction studies are being made on precipitated hydrous lanthanide oxides and hydroxides prepared and aged under a variety of conditions. Electron diffraction and electron microscopy studies are being made on the aging of hydrous PuO2 and on precipitated hydrous oxides and hydroxides of trivalent Cf and Bk. NSA

N70-31685 Florida Univ., Gainesville.
THE RELATION OF THE KINETICS OF CRYSTALLIZATION TO THE MECHANICAL PROPERTIES OF Li2O-SiO2 GLASS-CERAMICS
Stephen W. Freiman (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-17019

Ceramics formed from glass in the Li2O-SiO2 system were investigated to obtain understanding of both the mechanism of nucleation and crystallization and the effect of crystallization on the mechanical properties of the material. It was found that the nucleation treatment given the samples greatly affected both the crystallization rate and the activation energy for crystallization. Analysis of the results through a modified form of the Johnson-Mehl-Avrami equation shows that the nucleation activation energy is reduced during the more effective nucleation treatments. Use of the JMA equation also shows that crystal growth occurs in the form of rods. The crystalline morphology is substantiated by micrographs showing a spherulitic growth habit. Dissert. Abstr.

N70-31686 Princeton Univ., N.J.
MECHANICS OF TWO-PHASE FLOW: COUNTERCURRENT AND COCURRENT COGRAVITY FLOW OF VERTICAL FLUIDIZED SYSTEMS OF MIXED SIZES OF SOLID PARTICLES
Ehud Finkelstein (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-18162

The general theory of Lapidus and Elgin for the mechanics of vertical moving fluidized systems was investigated for solid particles of mixed sizes in countercurrent and cocurrent cogravity systems. The results show that at low holdups almost no interaction exists between particles of different sizes. The total holdup is the sum of the holdups which would occur for each particle size at the same flow rate as fed in the mixture of sizes and is readily predictable from the basic theory. Selective flooding can occur, that is, while one particle size passes through the tower the system is flooded with respect to the other. For selective flooding to occur it is required that the flow rate of the continuous phase exceed only that corresponding to flooding of one particle size (the flooded size) at its feed rate, but not that of the other size. A two stage process for particle size separation was simulated by the computer using the above flooding mechanics and results for various conditions were calculated. Dissert. Abstr.

N70-31696# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
DETERMINATION OF CATION EXCHANGE CAPACITY OF EARTH MATERIALS USING A RADIOTRACER TECHNIQUE
R. P. Murrmann, R. C. Ryenolds, and D. Leggett Feb. 1970 17 p refs
(AD-702907; CRREL-RR-283) Avail: CFSTI CSCL 8/7

Two radiochemical methods were investigated for determining the cation exchange capacity of earth materials having a wide range in physicochemical properties. The first method attempted was unsuccessful but involved determination of the radioactivity of a 22Na-NaOAc solution in isotopic equilibrium with a Na(+)-saturated mineral phase. The logic of this method is presented in order to illustrate principles of isotopic exchange in mineral systems. The method finally adopted is based upon determination of the radioactivity of a salt-free, Na(+)-saturated mineral sample prepared using a radioactive NaOAc solution with a known 22Na-NaOAc composition. This method is less time-consuming and more accurate than the conventional ammonium acetate method for cation exchange capacity determinations. Author (TAB)

N70-31726# Cornell Univ., Ithaca, N.Y. Materials Science Center.
PHOTOELECTRONIC PROCESSES AND A SEARCH FOR EXCITON MOBILITY IN PURE AND DOPED ALKALI HALIDES
Steven William Duckett (Ph.D. Thesis) Sep. 1969 146 p refs
(Contract Nonr-401(47))
(AD-703245; MSC-TR-30; MSC-1221) Avail: CFSTI CSCL 20/12

A search has been conducted for evidence of exciton motion in the alkali halides. Two types of experiments were performed. In both sets of experiments diffusion of photon-created excitons to some detector whose output could be monitored was looked for. In the first type of experiment the detector was a thin film on the surface of the alkali halide in which the excitons were created. The energy level structure of the film was such that the exciton energy of the bulk alkali halide was energetically sufficient to excite and eject an external electron from the film. The other type of experiment was done with iodine atoms substituted in KCl and KBr crystals. These iso-electronic impurities have localized excitonic states which are ionizable at 300 degrees K. The idea was to create excitons which might wander to an iodine site and then excite the state which thermally ionizes, producing a photocurrent. The quantum yield of the photocurrent excitation process was measured as a function of the iodine concentration. It is concluded that the experiments indicate a prompt relaxation of the exciton into some self-trapped state, probably a v sub k -type state as has been predicted by Wood. It is shown, using some of the analysis developed to interpret these experiments, that previous experiments, thought to have indicated exciton mobility, are in fact consistent with the relaxation model. Author (TAB)

N70-31757# Kernforschungsanlage. Juelich (West Germany). Institut fuer Festkoerper und Neutronenphysik.
THE CRITICAL EXPONENTS BETA AND DELTA FOR HYDROGEN AS LATTICE GAS PALLADIUM SILVER SUB 0.1 [DIE KRITISCHEN EXPONENTEN BETA UND DELTA FUER WASSERSTOFF ALS GITTERGAS IN PALLADIUM SILBER]
H. Buck and G. Alefeld May 1969 11 p refs In GERMAN
(JUL-592-FN) Avail: CFSTI

Phase diagrams and solubility measurements for hydrogen lattice gas in a palladium-10% silver system are evaluated for transformations and critical point. A three dimensional lattice gas model is used to obtain concentration and temperature values near the critical point and to determine their critical exponents. Transl. by G.G.

N70-31882*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF THE PREPARATION OF MATERIALS IN SPACE Final Report
L. R. Mc Creight, E. C. Henry, R. N. Griffin, and B. A. Rubin (Wyeth Labs.) Mar. 1970 90 p refs
(Contract NAS8-24683)
(NASA-CR-102749) Avail: CFSTI CSCL 20B

The objective of this investigation has been to collect or generate and assess ideas for the exploitation of the space environment to process materials for use on earth. Microgravity or nearly zero-g is the most unique aspect of space which is unavailable on earth and it is therefore the principal aspect of space on which this study is focused. Other aspects of the space environment however were also considered as at least adjuncts of microgravity benefited processes. The principal ideas recommended for the space processing of materials are summarized with a brief statement of the purpose for each process. Of seven recommended areas for space processing experiments which were considered in this program, the major effort was devoted to electronic crystals grown from solution. This effort included both the survey of ideas for space processing of single crystals and considerable experimental work on the development of a new solution-type process principally used to demonstrate the growth of potassium sodium niobate crystals from a solution of potassium sodium silicate glass. Author

N70-31912 Clemson Univ., S. C.
AN INVESTIGATION INTO THE DEPENDENCE OF THE SUPERCONDUCTING ENERGY GAP ON THICKNESS IN THIN LEAD FILMS
Robert Riggs Marchini (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-19736

THe superconducting energy gap of lead was measured by the electron tunneling method. The lead samples were in the form of vacuum deposited films. The dependence of the energy gap value on film thickness was then determined using a multiple beam interferometer. The data from the tunneling measurements were unusual in that an anomalous ohmic current appeared within the gap region. The gap measurements from this data ranged from 2.38 meV to 2.72 meV. A definite dependence of the energy gap upon thickness was found. This dependence was found to qualitatively fit the curve predicted by Singh. Better agreement might have been obtained by plotting the energy gap as a function of the resistivity thickness of the films. It was also found that the anomalous ohmic current seemed to be best explained by assuming the edges of the lead films remained normal. Dissert. Abstr.

N70-31948# Kentucky Research Foundation, Lexington. Dept. of Physics and Astronomy.
ELECTRICAL CHARACTERISTICS OF A METAL-SEMICONDUCTOR CONTACT, PART 1 Progress Report
B. R. Gossick 1 Mar. 1970 35 p refs
(Contract AT(40-1)-3651)
(ORO-3651-4) Avail: CFSTI

The transmission and reflection coefficients related to electron propagation at oblique incidence on a boundary between two different crystals, and the wave function in an abrupt boundary region are determined. The mean transmission coefficient averaged over all angles of incidence is obtained as a function of energy, and this is used to determine the boundary layer resistance in the metal where electrons enter the semiconductor and the boundary layer resistance in the semiconductor where electrons enter the metal. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-30643# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INHIBITORS AND CATALYSTS FOR THE EXOTHERMIC DECOMPOSITION OF AMMONIUM PERCHLORATE, JULY 1968 - JUNE 1969
E. K. Weinberg, S. W. Mayer, and L. Schieler 13 Mar. 1970 37 p refs
(Contract F04701-69-C-0066)
(AD-702803; TR-0066(5210-10)-315; SAMSO-TR-70-96) Avail: CFSTI CSCL 21/2

In order to enhance extinguishment reliability of controllable solid-propellant motors, an investigation has been made by differential thermal analysis to search for additives or techniques that could eliminate or inhibit the normal first exotherm of propellant grade ammonium perchlorate (AP). It was found that the temperature at which this first AP exotherm occurred could be raised 85C by adding 1.5% ammonium hexafluorophosphate. The additive was also effective when fluorocarbon binder was in contact with the AP. A series of tests was made of the catalytic effect on this exotherm of traces of impurities in AP. Although the first AP exotherm was strongly catalyzed by as little as 0.04% of copper nitrate, the catalysis was suppressed by the NH_4PF_6 additive. The burning rate was increased by adding 0.1% Cu or Zn salts. Independent tests in a combustion-bomb and in a motor have demonstrated the increased extinguishment reliability suggested by the thermal analysis curves. The effect on AP decomposition and combustion exotherms has also been tested for a series of additives consisting of other ammonium salts, flame retardants, Lewis acids, and transition metal compounds. Author (TAB)

N70-30950# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
LOW TEMPERATURE BEHAVIOR OF N-5 PROPELLANT
Duwayne M. Anderson, Allen Tice, and Brian Bartizek Jan. 1970 28 p refs
(AD-700997; CRREL-SR-142) Avail: CFSTI CSCL 21/9

The low temperature behavior of several samples of N-5 rocket propellant was studied using DTA. The only significant occurrence during cooling to -100C was the glass transition. The temperature of this transformation was found to be -58F plus or minus 3F by dilatometry. In addition, the variability of tensile strength, elongation, and strength modulus among three producers was examined. Significant variations were found among lots from any one plant; but variations in the average values for each plant were not significant. Author (TAB)

N70-31079# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
IGNITION DELAYS OF HYDROGEN-AIR MIXTURES AT PRESSURES UNDER 1 atm AND TEMPERATURES OF AROUND 1000K [ZUENDVERSUGSZEITEN VON WASSERSTOFFLUFTGEMISCHEN BEI DRUECKEN UNTER 1 AT UND TEMPERATUREN UM 1000K]
T. Just and F. Schmalz *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 41-58 refs In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

The ignition delay times of stoichiometric hydrogen-air mixtures were measured in a shock tube in the 900-1300 K range and at pressures of about 0.4-1.5 atm. The results can be explained by the strong effect of chain-breaking through the triple collision $H+O2+M$ yields $HO2+M$. The ignition delay times at higher temperatures were almost inversely proportional to the pressure but at lower temperatures they appear to be directly proportional to the pressure. An approximate solution of the basic reaction mechanism agrees with the measurements. ESRO

N70-31080# Technische Hochschule Darmstadt (West Germany). Inst. fuer Chemische Technologie.
SPECIAL INVESTIGATIONS OF RECIRCULATION ZONES OF TURBULENT PROPANE-AIR FLAMES [EINIGE SPEZIELLE UNTERSUCHUNGEN AN REZIRKULATIONSZONEN TURBULENTER PROPAN-LUFT-FLAMMEN]
H. Peschel *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 59-76 In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

Researches on turbulent propane-air flames are summarized. The stability of the flames depends on the temperature, concentration, and velocity fields and several flame configurations are discussed. ESRO

N70-31081# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
A MEASUREMENT CONFIGURATION FOR THE INVESTIGATION OF AERODYNAMIC FLAME STABILIZATION AT HIGHER PRESSURES [UEBER EINE

MESSEINRICHTUNG ZUR UNTERSUCHUNG DER AERODYNAMISCHEN FLAMMENSTABILISIERUNG BEI HOEHEREN DRUECKEN]

K.-D. Emmenthal *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 77-92 refs In GERMAN (See N70-31076 16-28)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

A configuration for determining the boundary velocity in a tubular afterburner, using aerodynamic flame stabilization is described. The fuel arrangement was kept as simple as possible, the maximum operating pressure was up to 6 kp/sq cm and the maximum initial flow velocity was 300 m/sec. ESRO

N70-31381# AiResearch Mfg. Co., Phoenix, Ariz.

EVALUATION OF SHELLDYNE-H FUEL FOR GAS TURBINE ENGINE USE Final Report, Jun. - Nov. 1969

Robert S. Mc Carty and Edward L. Brandys Mar. 1970 198 p refs

(Contract F33615-69-C-1864)

(AD-703691; PE-8067; ASD-TR-70-2) Avail: CFSTI CSCL 21/4

Shelldyne-H fuel was evaluated with an AiResearch Model GTP30 Gas Turbine Engine, and some of its components. Fuel properties data supplied by Shell Oil Company were verified. Elevated-temperature aging tests of various elastomers indicated that Viton A, LS-53, and Buna N are compatible with Shelldyne-H fuel, and that materials containing straight silicone compounds are incompatible with Shelldyne-H fuel. Fuel control tests, including fuel-pump tests were performed at temperatures down to minus 65 degrees F. Low temperature pump cavitation was experienced. Ignition was a problem, but combustion tests revealed good efficiency and temperature distribution after combustion was achieved. Engine starts with Shelldyne-H fuel could be made above plus 10 degrees F with the use of a cartridge starter gas system. Engine starts could be made above minus 40 degrees F, if ignition was initiated with MIL-T-5624 Grade JP-4 fuel. A system problem, identified at low temperatures, was a means to get all usable fuel from the fuel tank to the engine because fuel adhered to the tank walls. Author (TAB)

N70-31883*# Chrysler Corp., New Orleans, La. Space Div.

EVALUATION OF A PENTAPROPELLANT UPPER STAGE

P. D. Thompson, Jr. 25 Jul. 1970 52 p refs

(Contract NASw-1965)

(NASA-CR-110531; TR-AE-70-30) Avail: CFSTI CSCL 22B

An investigation was made to determine if an H2/FLOX/Li-Be pentapropellant stage would be sufficiently attractive to merit further investigations. The stage had a hybrid combustion system. The liquid propellants were stored in tanks, while the lithium and beryllium were a solid grain in a case similar to a solid rocket motor. The result of the exploratory analysis indicates that an H2/F2 bipropellant stage is superior to the pentapropellant state. The large size and weight of the pentapropellant engine is the reason for its low performance relative to the bipropellant stage. Even though the pentapropellant stage engine parameters and combustion chamber shape were not optimized, it is doubtful that the capability of the pentapropellant stage could be improved sufficiently by optimizing these parameters to give it a significant payload advantage over the bipropellant stage. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-31076# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Porz (West Germany).

PROCEEDINGS OF THE WGLR MEETING ON AIR-BREATHING ENGINES [BERICHT UEBER DIE SITZUNG DES WGLR-FACHAUSSCHUSSES FUER LUFTANSAUGENDE TRIEBWERKE]

Dec. 1969 314 p refs In GERMAN; ENGLISH summary Conf. held at Munich, 29-30 Nov. 1967

(DLR-Mitt-69-23) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

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9. THE CALCULATION OF SPATIAL GAS VIBRATIONS WITH RANDOM FLOW VELOCITY DISTRIBUTION B. Jaeger (Daimler-Benz) p 161-182 refs (See N70-31085 16-28)

10. INVESTIGATION OF ROTATING INJECTION FOR PROPELLANT UNITS WITH AXIAL COMPRESSORS A. Kayser (DVL, Porz) p 183-198 refs (See N70-31086 16-28)

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12. DEVELOPMENT OF THE COMBUSTION CHAMBER OF THE MAN TURBO 6022 GAS TURBINE H. Hagen (MAN AG, Munich) p 217-230 (See N70-31088 16-28)

13. REQUIREMENTS OF ENGINE DYNAMICS IMPLIED BY THE THRUST MODULATION CONTROL FOR VTOL AIRCRAFT H. G. Offenbeck (Entwicklungsring Sud) p 231-238 (See N70-31089 16-28)

14. THE CONTROL CIRCUIT REPRESENTATION OF THE DYNAMIC CHARACTERISTICS BEHAVIOR OF ENGINES AND THE DYNAMIC ENGINE IMITATION FOR THE DO-31 SIMULATION D. Bux (Dornier-Werke) p 239-250 (See N70-31090 16-28)

15. SIMPLIFIED SIMULATION OF DYNAMIC BEHAVIOR OF AIRCRAFT ENGINES A. Straubinger (Entwicklungsring Sud) p 251-270 (See N70-31091 16-28)

16. RECIRCULATION, A DYNAMIC DISTURBANCE OF AIRCRAFT ENGINE BEHAVIOR F. Aulehla (Entwicklungsring Sud) p 271-292 (See N70-31092 16-28)

17. INFLUENCE OF THE QUALITY OF SEPARATE COMPONENTS ON THE STATIC AND DYNAMIC BEHAVIOR OF JET ENGINES F. Fett (Tech. Hochschule Aachen) p 293-316 (See N70-31093 16-28)

N70-31077# Deutsche Versuchsanstalt fur Luft- und Raumfaurt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
PROPELLANTS FOR HYPERSONIC FLIGHT [KRAFTSTOFFE FUER DEN UEBERSCHALLFLUG]
G. Spengler *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 9-24 In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

Hypersonic flight conditions are surveyed and fuel requirements for the Mach 2 to 7 range are listed. Economic aspects of the concorde fuel system are discussed. It is shown that for the first SST aircraft improved conventional fuels, e.g. Jet A-1 and ATK will be suitable. At higher Mach numbers highly purified thermostable fuels with a CH basis will have to be used. ESRO

N70-31082# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
FLOW AND COMBUSTION INVESTIGATIONS IN AFTERBURNERS WITH AERODYNAMIC FLAME STABILIZATION [STROEMUNGS- UND VERBRENNUNGSUNTERSUCHUNGEN IN NACHBRENNERN MIT AERODYNAMISCHER FLAMMENSTABILISIERUNG]
R. Ulken *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 93-116 refs In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

Investigations of a model afterburner and that of a Marbore engine showed the advantages and possible applications of aerodynamic flame stabilization. Extensive direction measurements were undertaken in the stabilizing area of a rectangular combustion chamber. A special five-tube probe was used at 1700 C, without damage. After simple temperature measurements, the trajectory curves of a cold compressed air jet in a preheated cross-current were determined. Measurements agreed with computed trajectories. ESRO

N70-31083# Deutsche Versuchs anstalt fur Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
THE PRODUCTION OF SINGLE DROPS FOR INVESTIGATING THE BEHAVIOR OF DROPS IN COMBUSTION CHAMBERS [DIE HERSTELLUNG VON EINZELTROPFEN UNTERSUCHUNGSMETHODEN UEBER DAS VERHALTEN VON TROPFEN IN BRENNKAMMERN]
W. Trommsdorff and H. Wiegand *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 117-138 refs In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

One can produce a regular series of drops of equal mass with diameters of 200-600 microns from fluid jets in atmospheric air. Water, diesel-engine oil, and glycerine drops were generated with a hypersonic vibrator and a fluid jet. Electronic measuring instruments, high energy flashes, and a high-speed camera were used. The results agreed with theoretical predictions. ESRO

N70-31084# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
THE INJECTION OF LIQUID AND GASEOUS MEDIA IN HYPERSONIC FLOW [DIE EINSPRITZUNG VON FLUESSIGEN UND GASFOERMIGEN MEDIEN IN UEBERS CHALLSTROEMUNGEN]
M. Kallergis *In* DLGR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 139-160 refs In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

The main flow consisted of a plane Mach 3 hypersonic jet. Pipes, nozzles, and cavities in the wall were used as fuel injectors. The influence of the wall boundary layer was neglected for pipes and nozzles extending into the main flow. For wall cavity injection, the boundary layer was eliminated by means of wedges. ESRO

N70-31085# Daimler-Benz, A. G., Stuttgart (West Germany).
THE CALCULATION OF SPATIAL GAS VIBRATIONS WITH RANDOM FLOW VELOCITY DISTRIBUTION [DIE BERECHNUNG VON RAEUMLICHEN GASSCHWINGUNGEN MIT BELIEBIGER VERTEILUNG DER STROEMUNGSGESCHWINDIGKEIT]
B. Jaeger *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 161-182. refs In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

A three dimensional wave equation was derived in cartesian and cylindrical coordinates, taking the flow velocity into consideration, and a stepwise and direct method was devised for a digital computer (with random gas states and boundary conditions). Applications to vibration processes in rocket combustion chambers and the afterburners of flight propulsion units are considered. ESRO

N70-31086# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
INVESTIGATION OF ROTATING INJECTION FOR PROPELLANT UNITS WITH AXIAL COMPRESSORS [UNTERSUCHUNG DER ROTIERENDEN EINSPRITZUNG FUER TRIEBWERKE MIT AXIALVERDICHTER]
A. Kayser *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Engl Dec. 1969 p 183-198 refs In GERMAN (See N70-31076 16-28) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

The use of rotating fuel injection for combustion chambers with axial flow was investigated. In addition to varying the air throughput, fuel-air ratio and the propulsory revolution rate, the combustion chamber pressure dependence was also investigated. ESRO

N70-31087# Daimler-Benz, A. G., Stuttgart (West Germany).
PROBLEMS OF COMBUSTION CHAMBER DEVELOPMENT [PROBLEME DER BRENNKAMMER-ENTWICKLUNG]
J. Schmidt *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 199-216 refs In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

The problems involved in the development of combustion chambers, high combustion chamber pressures, chamber inlet and exhaust temperatures are discussed. With increasing pressure and temperature the following main problems in combustion chamber development were identified: development of economical cooling methods; reduction of flame radiation at high pressures; development of new combustion chamber materials; and new injection and burning systems. ESRO

N70-31088# Maschinenfabrik Augsburg-Nurnberg A. G., Munich (West Germany).
DEVELOPMENT OF THE COMBUSTION CHAMBER OF THE MAN TURBO 6022 GAS TURBINE [ENTWICKLUNG DER BRENNKAMMER DER GASTURBINE MAN TURBO 6022]
H. Hagen *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 217-230 In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66,36 DM

The MAN Turbo 8022 engine is a single-shaft propulsion unit consisting of a two-stage radial compressor, a single combustion chamber, and a three-stage axial turbine. A description is given of the problems encountered in the development of the combustion chamber. ESRO

N70-31089# Entwicklungsring Sud, Munich (West Germany).
REQUIREMENTS OF ENGINE DYNAMICS IMPLIED BY THE THRUST MODULATION CONTROL FOR VTOL AIRCRAFT [ANFORDERUNGEN AN DIE TRIEBWERKSDYNAMIK BEDINGT DURCH DIE SCHUBMODULATIONSSTEVERUNG BEI VTOL-FLUGZEUGEN]
H. G. Offenbeck *In* DLGR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 231–238 In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

In the design of V/STOL high performance aircraft the choice of the engines and the control systems plays and important role for gliding and transition flight. For the control system, and the choice of engine for thrust modulation control, there are three dynamic criteria: a) stabilization for small disturbances; b) stabilization for engine failure; c) control behavior. ESRO

N70-31090# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THE CONTROL CIRCUIT REPRESENTATION OF THE DYNAMIC BEHAVIOR OF ENGINES AND THE DYNAMIC ENGINE IMITATION FOR THE DO-31 SIMULATION [DIE REGELUNGSTECHNISCHE DARSTELLUNG DES DYNAMISCHEN VERHALTENS VON TRIEBWERKEN UND DIE DYNAMISCHE TRIEBWERKSNACHBILOUNG BEI DER DO-31-SIMULATION]
D. Bux *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 2969 p 239–250 in GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

With the increasing demand for precise aircraft simulation data the pure digital approach becomes important and is also applicable to propulsion simulation. Digital simulation diagrams were established for the dynamic behavior of aircraft engines, particularly the DO-31 engine. ESRO

N70-31091# Entwicklungsring Sud, Munich (West Germany).
SIMPLIFIED SIMULATION OF DYNAMIC BEHAVIOR OF AIRCRAFT ENGINES [VEREINFACHTE SIMULATION DES DYNAMISCHEN VERHALTENS VON TRIEBWERKEN]
A. Straubinger *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 251–270 In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

Three different methods for simulating the dynamic behavior of V/STOL aircraft engines with an analog computer are described. In the first method the thrust transfer functions were simulated, and in the second the time dependence of the functions were simulated by integration of the thrust derivatives obtained from available thrust response characteristics. The third method was based on the simulation of the fuel control operation and the engine. ESRO

N70-31092# Entwicklungsring Sud, Munich (West Germany).
RECIRCULATION, A DYNAMIC DISTURBANCE OF AIRCRAFT ENGINE BEHAVIOR [REZIRKULATION ALS DYNAMISCHER STOEREINFLUSS AUF DAS TRIEBWERKSVERHALTEN]
F. Aulehla *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 271–292 (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

The temperature variations in the inlet flow of V/STOL aircraft with TL propulsion due to recirculation, are described. The measurements were made using a 1:2 model. ESRO

N70-31093# Technische Hochschule Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
INFLUENCE OF THE QUALITY OF SEPARATE COMPONENTS ON THE STATIC AND DYNAMIC BEHAVIOR OF JET ENGINES [EINFLUSS DER GUETE DER EINZELKOMPONENTEN AUF DAS STATIONAERE UND DYNAMISCHE VERHALTEN VON STRAHLTRIEBWERKEN]
F. Fett *In* DGLR Proc. of the WGLR Meeting on Air-Breathing Eng. Dec. 1969 p 293–316 In GERMAN (See N70-31076 16-28)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 66.36 DM

A change in a single component of a jet engine not only influences the behavior of the component itself but also of the engine as a whole. There are several reasons for changing component quality and the consequent engine changes are described. ESRO

N70-31631# Purdue Univ., Lafayette, Ind.
RESEARCH IN THE GAS DYNAMICS OF JET ENGINES
R. Goulard and M. L'Ecuyer, eds. Feb. 1970 105 p
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-703974) Avail: CFSTI CSCL 21/5

On December 4-5, 1969, the ONR Chicago Branch was host to a gathering of 20 specialists from government, industry, and universities to participate in a Workshop to discuss the fluid dynamic problems likely to influence the design of future jet engines. The presentations and discussions which took place are recorded and area of needed research are outlined. TAB

N70-31743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING TURBINE BLADE OSCILLATIONS ON ANALOG COMPUTERS
L. D. Magomaev 20 Feb. 1970 15 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), no. 1, 1969 p 35–38
(AD-704013; FTD-HT-23-633-69) Avail: CFSTI CSCL 10/1

The article states a method for calculating resonance frequencies, oscillation forms and tangential pressures originating in a blade, with the aid of an analog computer based on mathematical simulation procedures. TAB

N70-31779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURRENT NASA RESEARCH IN TURBOJET PROPULSION
Eugene J. Mangeniello 1970 22 p refs Proposed for presentation at 7th Congr. of Intern. Council of the Aeron. Sci., Rome, 14-18 Sep. 1970
(NASA-TM-X-52807) Avail: CFSTI CSCL 21E

Intensive work discussed in inlet, compressor, combustor, turbine, and nozzle component technology, along with investigations of integrated engine systems, including inlet flow distortion effects on engine stall, and airframe - propulsion system interactions. Recent progress and experimental results are presented in each of these major areas of investigation. Author

N70-31780*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARATIVE IN-FLIGHT THRUST MEASUREMENTS OF

THE SERT 2 ION THRUSTER
William C. Nieberding, Daniel J. Lesco, and Frank D. Berkopec 1970 15 p refs Proposed for presentation at AIAA 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970
(NASA-TM-X-52839) Avail: CFSTI CSCL 21C

A description and analysis of the three methods used to measure the thrust of the SERT 2 ion thrusters in flight are given. The first is the use of the MESA accelerometer to measure the 2 micro resulting from the radial component of the thrust, the second is the use of telemetered beam electrical parameters to calculate thrust, and the third is the measurement of orbit change resulting from the thrust. It is shown that the three methods yield values of thrust which agree with each other within the error bands of the methods. It is concluded that the thrust was measured to within + or − 1% by the MESA, to within + or − 2.2% by beam electrical parameters, and to within about + or − 5% by orbit changing. Author

N70-31788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT AND GROUND PERFORMANCE OF THE SERT 2 THRUSTER
W. R. Kerslake, D. C. Byers, V. K. Rawlin, S. G. Jones, and F. D. Berkopec 1970 17 p refs Proposed for presentation at AIAA 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug.–2 Sep. 1970
(NASA-TM-X-52848) Avail: CFSTI CSCL 21H

The SERT 2 spacecraft was launched after 3 1/2 years of development and testing. A 15-cm diameter mercury electron bombardment ion thruster on board the spacecraft has operated for over 3 months of the 6-month mission goal. The overall thruster efficiency has remained constant at approximately 0.68. The specific impulse is about 4200 sec., and the thrust is 28 mN (6.3mlb) for a thruster input power of about 850 W. A second redundant flight thruster was operated briefly in space. The performance of both flight thrusters is compared with corresponding preflight ground testing. In addition, the endurance of one flight thruster is compared with two ground endurance tests of prototype thrusters. Author

N70-31827*# Dynamic Science, Irvine, Calif.
TECHNICAL AND MANAGERIAL SUPPORT FOR THE PERFORMANCE STANDARDIZATION WORKING GROUP OF THE INTERAGENCY CHEMICAL ROCKET PROPULSION GROUP Final Report
S. Hersh May 1970 70 p refs
(Contract NAS7-443)
(NASA-CR-110527; SN-82) Avail: CFSTI CSCL 21I

The ICRPG Performance Standardization Working Group was formed for the purpose of improving and recommending methodology suited to eventual adoption as national standards for the analytical and experimental evaluation of the performance of liquid propellant rocket engines. Key technical and management individuals from a broad spectrum of government agencies, propulsion, and space systems companies are organized into three technical committees. These three committees meet approximately every three months to develop propulsion system performance analysis methodology, improved theoretical analysis techniques, and improved experimental measurement and data analysis methods. Author

N70-31829*# Aerojet Liquid Rocket Co., Sacramento, Calif.
COATINGS FOR REGENERATIVE ENGINES (FOLLOW-UP PROGRAM) Final Report, 1 Jul. 1968–30 Jan. 1970
W. J. Lewis 6 Jul. 1970 96 p refs
(Contract NAS3-7955)
(NASA-CR-72653; ALRC-2100-3; FR-2) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740

Plasma-sprayed thermal barrier coatings were evaluated for the flame surface of a regeneratively-cooled chamber operating with flox/hydrocarbon propellants. The coatings were subjected to laboratory screening tests using a plasma torch to simulate the thermal environment. Coatings also were placed into the exhaust stream of a flox/propane rocket engine to simulate the chemical environment. Concurrently, an injector and rectangular chamber were designed to operate with flox/methane propellants. Two, replaceable, cooled test panels formed the convergent-divergent contour of the chamber. Plasma-sprayed coatings were applied to the test panels and evaluated in the exhaust stream at the chamber, throat, and exit areas. These tests revealed that the coating system consisting of a flame liner of tungsten (> 95% density) provided the lowest regression rate. Author

N70-31904*# Aerojet Solid Propulsion Co., Sacramento, Calif. Space Booster Dept.
INVESTIGATION OF EFFECTS OF ABLATIVE DISCREPANCIES ON NOZZLE PERFORMANCE RELIABILITY Final Report
J. J. Warga Jan. 1970 148 p refs
(Contract NAS3-12008)
(NASA-CR-72702) Avail: CFSTI CSCL 21H

Carbon and silica fabric reinforced ablative plastic nozzle components were fabricated with discrepancies introduced during the wrapping and curing cycles. The ablative performance of the components was evaluated after static test firing; the mechanical and physical properties of duplicate flame liners were determined at room and elevated temperatures. Structural and ablative performance predictions based on the measured properties were compared to the actual results and accept/reject criteria for the introduced discrepancies derived. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-30754*# Techtran Corp., Glen Burnie, Md.
ELEMENTARY PARTICLES AND COSMIC RAYS
V. A. Bezus et al, ed. Washington NASA May 1970 148 p refs Transl. into ENGLISH of the book 'Elementarnyye Chastitsy i Kosmicheskiye Luchi' Moscow, Atom Press, 1967 p 3–155
(Contract NASw-1695)
(NASA-TT-F-588) Avail: CFSTI CSCL 20H

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1. COSMIC RAYS AND VERY SLOW PARTICLES I. L. Rozenthal p 1–16 refs (See N70-30755 16-29)
2. THE ENERGY SPECTRUM OF COSMIC MUONS OF ULTRAHIGH ENERGIES AT SEA LEVEL V. V. Borog et al p 17–29 refs (See N70-30756 16-29)
3. ELASTIC PION(+)-PROTON SCATTERING AT A PION(+) ENERGY AT 2.06 GeV S. P. Kruchinin et al p 30–35 refs (See N70-30757 16-24)
4. THE MASS SPECTRUM OF SYSTEMS OF STRANGE PARTICLES GENERATED BY THE INTERACTION OF PIONS WITH LIGHT NUCLEI V. S. Demidov et al p 36–43 refs (See N70-30758 16-24)
5. THE THEORY OF COMPLEX MOMENTS AND RESONANCE NUCLEAR REACTIONS V. V. Grushin et al p 44–64 refs (See N70-30759 16-24)
6. A UNIVERSAL METHOD OF PROCESSING THE TRACKS OF ARBITRARY CURVATURE ON BUBBLE CHAMBER TRACKS K. N. Mukhin et al p 65–76 refs (See N70-30761 16-24)

7. A METHOD OF REGISTERING THE ENERGY OF CHARGED PARTICLES WITH A PROPORTIONAL LIGHT COUNTER V. G. Varlamov et al p 77–80 ref (See N70-30761 16-24)

8. MODELING PROCESSES WITH GENERATION OF NEUTRAL PARTICLES IN NON-HYDROGEN BUBBLE CHAMBERS K. N. Mukhin et al p 81–88 refs (See N70-30762 16-24)

9. GENERATION OF HIGH-ENERGY MUONS DURING INTERACTION OF COSMIC RAY NUCLEI OF AIR Yu. D. Kotov p 89–93 refs (See N70-30763 16-24)

10. COSMIC GAMMA-RADIATION A. M. Galper et al p 94–111 refs (See N70-30764 16-24)

11. ABSORPTION OF PIONS BY COMPLEX NUCLEI V. G. Kirillov-Ugryumov et al p 112–120 refs (See N70-30765 16-24)

12. STUDY OF THE PHYSICAL AND CHEMICAL PROPERTIES OF THE SURFACES OF SOLIDS USING NUCLEAR GAMMA-RESONANCE (THE MOSSBAUER EFFECT) I. P. Suzdalev p 121–143 refs (See N70-30766 16-24)

N70-30755*# Techtran Corp., Glen Burnie, Md.
COSMIC RAYS AND VERY SLOW PARTICLES
I. L. Rozenthal *In its* Elementary Particles and Cosmic Rays May 1970 p 1–16 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 20H

It is shown that an area exists where the characteristics of relativistic interactions overlap with properties of extremely slow particles (compared to cosmic rays), a significant fraction of cosmic ray energy is converted into ionization, i.e., into kinetic energy of slow electrons with energies of the order of 10-1,000 electron volts, i.e., close to the ionization potential. Before the energy of these electrons is converted into heat, they will radiate (during atomic excitation or during deceleration), which leads to new phenomena. The various mechanisms which generate slow particles are described. Author

N70-30756*# Techtran Corp., Glen Burnie, Md.
THE ENERGY SPECTRUM OF COSMIC MUONS OF ULTRAHIGH ENERGIES AT SEA LEVEL
V. V. Borg et al *In its* Elementary Particles and Cosmic Rays May 1970 p 17–29 refs (See N70-30754 16-29)
Avail: CFSTI CSCL 03B

This article is devoted to consideration of the energy spectrum in relation to the problem of cosmic muon origin. A comparison of the spectra measured in vertical and horizontal directions at sea level in the energy range of greater than or approximately 10 to the 11th power ev is carried out. The article also compares the energy spectra measured at different zenith angles in order to clarify the generation mechanism of ultrahigh energy muons. Author

N70-30777*# Aztec School of Languages, Inc., Maynard, Mass.
SOLAR CORPUSCULAR RADIATION ACCORDING TO THE DATA OF MEASUREMENTS ON SATELLITES AND ROBOT SPACE STATIONS
A. S. Dvoryashin *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 1–29 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Data on corpuscular radiation which were obtained from geophysical observations and space probes are reviewed. The existence of a four-streamer structure bringing about four sequences of geomagnetic disturbances is established. Each streamer carries a magnetic field of mainly one polarity. The four-streamer model of the interplanetary magnetic field which has definite boundaries and exists during several revolutions of the Sun is described. Author

N70-30917# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Dec. 1969 17 p Prepared for Council of Sci. and Ind. Res.
(RRC-A-174-Pt-2; Rept-S-G-47) Avail: CFSTI

Solar and geophysical data compiled for ionospheric studies are presented, based on observations made up to Nov. 1969. Tables of predicted and observed sunspot numbers and solar flux are given. Solar flares and solar flare effects (crochets) are listed as well as ionospheric effects of solar flares. Magnetic storm data and diagrams of SID events are shown. Author

N70-31096*# Scientific Translation Service, Santa Barbara, Calif.
COMPUTER SIMULATION OF RADIATION SCATTERING IN A SPHERICAL NEBULA WITH A CENTRAL POINT SOURCE [MODELERIVANIYE NA VYCHISLITELNOY MASHINE BESM-3M RASSEYANIYA IZLUCHENIYA V SFERICHESKOY TUMANNOSTI S TSENTRALNYM]
A. V. Kurchakov et al Washington NASA Jun. 1970 19 p refs Transl. into ENGLISH from Issled. Tumannostey i Mezhvezdnoy Sredy. Tr. Akad. Nauk Kazakhsk. SSR, Astrofiz. Inst. (Alma-Ata), v. 11, 1968 p 3–42
(Contract NASw-2035)
(NASA-TT-F-13105) Avail: CFSTI CSCL 03B

The problem of computer simulation of the radiation scattering in a spherically symmetric medium (nebula) containing a central isotropic radiation source (star) is discussed. A program for solving the problem on a BESM-3M computer is proposed, in which the optical radius and the particle albedo of the nebula and the radiation scattering factor are used as parameters characterizing the optical characteristics of the nebula. Author

N70-31228# California Univ., Berkeley. Cosmic Ray Group.
PARTICLE BOMBARDMENT OF THE POLAR ATMOSPHERE Final Report, 1 Oct. 1968–31 Dec. 1969
Robert R. Brown, Robert A. Weir, E. W. Hones, Jr., R. Parthasarathy, and Richard H. Karas Jan. 1970 9 p refs
(Grant AF-AFOSR-331-67)
(AD-702854; AFOSR-70-0141TR) Avail: CFSTI CSCL 4/1

The program of research was directed at studying the bombardment of the polar atmosphere by radiations accompanying solar and magnetic disturbances. The program was based on using radiation detectors on balloon-borne platforms and measuring the fluxes, spectra, time variations and geophysical associations of the incoming radiation. The radiation encountered at high latitudes consisted of protons, accelerated at the sun and propagated through interplanetary space to the earth, and electrons, accelerated within the magnetosphere of the earth and guided to high latitudes by the geomagnetic field. Author (TAB)

N70-31405# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A SEARCH FOR COSMIC SOURCES OF GAMMA RAYS WITH ENERGIES BETWEEN .1 AND 100 TeV
G. H. Rieke (Ph.D. Thesis—Harvard Univ.) May 1969 98 p refs Sponsored in part by NSF
(SAO-Special-Rept-301) Avail: Issuing Activity

Theoretical estimates of gamma-ray fluxes from a number of cosmic objects are presented; conditions under which detectable fluxes would be generated by M 87, the Crab Nebula, M 82, and Cas A are discussed in detail. The apparatus used at the Smithsonian Astrophysical Observatory to search for sources of gamma rays with energies in the region by detection of the Cerenkov radiation from cosmic-ray air showers is described. The design of a 10-m aperture reflector used to concentrate this radiation is discussed. Experimental results for a number of sources are presented; the results are interpreted on the basis of a detailed theoretical study of the Cerenkov radiation from 0.1 TeV gamma-ray-initiated air showers. No statistically significant effects have been recorded. In particular, reports of possible fluxes from the Crab Nebula and CP 1133 have not been verified. It is concluded from the upper limit

established for the Crab Nebula that the effective magnetic-field strength in this object is greater than 0.00015 gauss. In addition, it is shown that the synchrotron-emitting electrons in this object do not originate through the decay of mesons produced in proton-proton collisions even if the extrapolation of the synchrotron spectrum to the X-ray region is denied. Author

N70-31563# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
MECHANICS ON THE ORIGIN OF THE VAN ALLEN BELT
G. Pizzella Mar. 1970 16 p refs
(Contract N00014-68-A-0196-0003)
(AD-703674; Rept-70-9) Avail: CFSTI CSCL 4/1

A model of the Van Allen belt is proposed in which the resonance acceleration of the exospheric plasma particles by stochastic electromagnetic waves plays an important role. The differential energy spectrum for trapped protons is derived in the energy range approximately equals 200 keV to a few MeV for L shells between about 2 and 6 earth radii. Author (TAB)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-30644# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE PARTICLE ENVIRONMENT AT THE SYNCHRONOUS ALTITUDE, JANUARY–JUNE 1969
George A. Paulikas and J. Bernard Blake 31 Dec. 1969 63 p refs
(Contract F04701-69-C-0066)
(AD-702799; TR-0066(5260-20)-15; SAMSO-TR-70-78) Avail: CFSTI CSCL 4/1

The particle environment at the synchronous orbit is summarized. Included in this report is a discussion of the properties of the trapped relativistic electron fluxes and the phenomenology of the penetration of solar protons to the synchronous orbit. Author (TAB)

N70-30676# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 228 13 May 1970 p 1–6 (See N70-30675 16-34)
Avail: CFSTI

Reviews are presented of submillimeter astronomy, philosophical and methodological analysis of current status of astronomy, the role of spectroscopy in astrophysics, new star clusters, problems of recording solar radio emission at waves shorter than critical, the use of photogrammetry in operating rotating antenna systems, the plasma envelopes of comets, a computer program for processing polarization observations, and a television device for guiding in the prime focus. R.B.

N70-30778*# Aztec School of Languages, Inc., Maynard, Mass.
ASTROMETRY AND ASTROPHYSICS, NO. 4: PHYSICS OF COMETS
V. P. Konopleva, ed. Washington NASA Jun. 1970 203 p refs Transl. into ENGLISH of the book "Astrometriya i Astrofizika. 4, Fizika Komet" Kiev, Naukova Dumka, 1969 p 1–222
(Contract NASw-1692)
(NASA-TT-F-599) Avail: CFSTI CSCL 03B

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2. A FOUR-STREAMER MODEL OF THE SOLAR CORONA NEAR THE ACTIVITY MINIMUM A. S. Dvoryashin p 30–42 refs (See N70-30778 16-30)

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4. AN ANALYSIS OF THE SURFACE BRIGHTNESS DISTRIBUTION IN THE TAIL OF THE COMET 1958h G. K. Nazarchuk p 63–84 refs (See N70-30780 16-30)

5. HYDRODYNAMICS OF THE CIRCUM-NUCLEAR REGION OF A COMET L. M. Shulman p 85–99 refs (See N70-30781 16-30)

6. THE PHYSICAL CONDITIONS IN THE BOUNDARY LAYER OF A COMETARY NUCLEUS L. M. Shulman p 100–109 refs (See N70-30782 16-30)

7. SOME PROBLEMS IN PHOTOELECTRIC OBSERVATIONS OF COMETS V. Vanysek p 110–115 refs (See N70-30783 16-30)

8. SOME PROBLEMS IN THE SPECTROSCOPY OF COMETS V. I. Cherednichenko p 116–123 refs (See N70-30784 16-30)

9. THE SPECTRUM OF THE TAIL OF COMET IKEYA-SEKI 1965f Z. V. Karyagina p 124–128 refs (See N70-30785 16-30)

10. POLARIMETRIC AND PHOTOMETRIC OBSERVATIONS OF COMET IKEYA-SEKI 1965f T. A. Polyakova et al p 129–134 refs (See N70-30786 16-30)

11. THE DENSITY OF SODIUM IN COMET IKEYA-SEKI 1965f E. A. Gurtovenko p 135–137 refs (See N70-30787 16-30)

12. PHOTOGRAPHIC PHOTOMETRY OF THE TAIL OF COMET IKEYA-SEKI E. S. Yeroshevich p 138–143 refs (See N70-30788 16-30)

13. THE PROBLEM OF THE DUST COMPONENT OF THE COMETARY ATMOSPHERE M. Z. Markovich p 144–151 refs (See N70-30789 16-30)

14. BRIGHTNESS VARIATION AND PHOTOMETRIC PARAMETERS OF COMET KILSTON 1966b G. A. Garazdo-Lenskyi et al p 152–163 refs (See N70-30790 16-30)

15. INVESTIGATIONS OF THE MOVEMENT OF COMETS CARRIED OUT BY THE INSTITUTE OF THEORETICAL ASTRONOMY OF THE ACADEMY OF SCIENCES OF THE USSR 1963–1966 N. A. Bokhan p 163–190 refs (See N70-30791 16-30)

16. ALL-UNION CONFERENCE ON THE PHYSICS OF COMETS V. I. Ivanchuk p 191–198 refs (See N70-30792 16-30)

N70-30778*# Aztec School of Languages, Inc., Maynard, Mass.
A FOUR-STREAMER MODEL OF THE SOLAR CORONA NEAR THE ACTIVITY MINIMUM
A. S. Dvoryashin *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 30–42 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

A four-streamer model of the solar corona was constructed for a period near a minimum of solar activity on the basis of satellite and rocket measurements of the plasma and field. The characteristic features of the magnetic disturbances in the Earth's magnetic field may be explained by the complex structure of the coronal streamers. This structure reflects the distribution of sources. Author

N70-30779*# Aztec School of Languages, Inc., Maynard, Mass.
SECULAR DECREASE IN THE ABSOLUTE BRIGHTNESS OF THE COMET ENCKE
Z. Sekanina *In its* Astrometry and Astrophys., No. 4 Jun. 1970

p 43-62 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

The brightness curves of Comet Encke are investigated in detail in this study on the basis of the returns from 1805 to 1961. The secular decrease of its absolute brightness ranges from 2m to 4m per century, which agrees with present results. Definition of the absolute magnitude, H sub 10, is found to be a good approximation of the comet's luminosity when the observations span a rather wide range of heliocentric distances. The method suggested which leads to a decrease of 1-1.1m per century, is shown to be absolutely erroneous. Author

N70-30780*# Aztec School of Languages, Inc., Maynard, Mass.
AN ANALYSIS OF THE SURFACE BRIGHTNESS DISTRIBUTION IN THE TAIL OF THE COMET 1956h
G. K. Nazarchuk *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 63-84 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Photometry was used to analyze the high-quality large-scale photographs of the comet Arend-Roland which were obtained with 40cm-telescope. A simple model was used for the data on the kinematic and physical parameters of the streams, with a consideration of the constant acceleration and dissocation of the luminous molecules and the expansion of the matter in the tail. All the parameters were determined by a comparison between the photometric and calculated results. It was found that the expansion of the matter in the tail was anisotropic; this may be due to the presence of a longitudinal magnetic field. Author

N70-30781*# Aztec School of Languages, Inc., Maynard, Mass.
HYDRODYNAMICS OF THE CIRCUM-NUCLEAR REGION OF A COMET
L. M. Shulman *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 85-99 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

The flow in the region of a comet's head around the nucleus is examined. Intermolecular collisions in this region are substantial, and the movement of the substance there is described in terms of hydrodynamics. It is shown that only supersonic flows can occur if the heating due to external radiation is not too great. The brightness distribution is found for the case of an adiabatic flow. The problem of the motion of dust particles in a supersonic flow is solved. The effect of heating the gases by external radiation is considered qualitatively. It is shown that a discontinuity in the density produces haloes which surround the nucleus of the comet under certain conditions. Author

N70-30782*# Aztec School of Languages, Inc., Maynard, Mass.
THE PHYSICAL CONDITIONS IN THE BOUNDARY LAYER OF A COMETARY NUCLEUS
L. M. Shulman *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 100-109 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

A connection is found between the initial parameters of the gaseous flow in the nucleus of a comet (density, velocity, temperature and pressure), and the temperature of the cometary nucleus on the basis of the laws of conservation. It is shown that the initial Mach number depends solely on the sublimation and accomodation coefficients. The initial velocity of the flow is found to be somewhat higher than that calculated on the basis of the assumption that a free molecular flow begins at the very surface of the nucleus and that the initial temperature is equal to the surface temperature of the nucleus. Author

N70-30783*# Aztec School of Languages, Inc., Maynard, Mass.
SOME PROBLEMS IN PHOTOELECTRIC OBSERVATIONS OF COMETS
V. Vanysek *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 110-115 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Methods of photoelectric observations of comets using narrow and wide band filters are discussed. Some possible combinations of filters yield a parameter q as equal to the intensity ratio between the continuous spectrum and the emission bands of CN, C sub 2 and C sub 3 molecules and the sodium lines, D sub 1 and D sub 2. The new physical classification of comets depends on this parameter. Author

N70-30784*# Aztec School of Languages, Inc., Maynard, Mass.
SOME PROBLEMS IN THE SPECTROSCOPY OF COMETS
V. I. Cherednichenko *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 116-123 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Some unidentified emissions in the spectra of comets are described, and possible interpretations are given. The existence of certain parent molecules and atoms yet undiscovered in comets is proven by some data. The subject is discussed on the basis of the fact that hydrogen atoms are abundant in the cometary atmosphere. The process of the recombination of negative hydrogen ions with positive ones is assumed to be a source of the continuous spectra of comets. The theoretical and observed brightness in the continuous spectrum and the position of the maximum in the spectral distribution are in good agreement for Comet Mrkos 1957V. Author

N70-30785*# Aztec School of Languages, Inc., Maynard, Mass.
THE SPECTRUM OF THE TAIL OF COMET IKEYA-SEKI 1965f
Z. V. Karyagina *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 124-128 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

The energy distribution in the spectrum of the tail of Comet Ikeya-Seki was obtained in absolute units. A comparison with the energy distribution in the solar spectrum shows that the spectral characteristics of the continuum of the tail are similar to those of the Sun, while the color of the tails of Comets Arend-Roland (1965h) and Mrkos (1957d) are redder than the color of the Sun. Author

N70-30786*# Aztec School of Languages, Inc., Maynard, Mass.
POLARIMETRIC AND PHOTOMETRIC OBSERVATIONS OF COMET IKEYA-SEKI 1965f
T. A. Polyakova et al *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 129-134 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

The results of photographic and photoelectric observations of the light polarization of Comet Ikeya-Seki (1965f) are given, as are the results of photographic photometry of the head of the comet in the region of the C sub 2 and C sub 3 bands. ... Author

N70-30787*# Aztec School of Languages, Inc., Maynard, Mass.
THE DENSITY OF SODIUM IN COMET IKEYA-SEKI 1965f
E. A. Gurtovenko *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 135-137 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Resonance scattering of photospheric radiation is the only mechanism which brings about emissions of the D sub 1 and D sub 2 lines of comets. This mechanism, and the data of spectral observations at Sacramento Peak, were used in order to estimate the number of atoms N and the mass of the sodium M in the head of Comet 1965f. The values obtained are almost equal to the corresponding estimates deduced from the emissions of other elements and compounds in ordinary comets (at a great distance from the Sun). This indicates that comets consist of heavy elements

(Na, Fe, etc.) to a considerable extent. These elements can be released from the nucleus of the comet only when they are near the Sun. Author

N70-30788*# Aztec School of Languages, Inc., Maynard, Mass.
PHOTOGRAPHIC PHOTOMETRY OF THE TAIL OF COMET IKEYA-SEKI
E. S. Yeroshevich *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 138-143 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

The results of photometric measurements of the tail of Comet Ikeya-Seki are given. The data were obtained from observations with a Schmidt camera. The isophotes of the head and tail of the comet are plotted. The quantity of dust is determined according to these data. Author

N70-30789*# Aztec School of Languages, Inc., Maynard, Mass.
THE PROBLEM OF THE DUST COMPONENT OF THE COMETARY ATMOSPHERE
M. Z. Markovich *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 144-151 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Certain properties of the dust component of the cometary atmosphere are considered: the mass of the dust, the number of particles in the cometary head, the concentration of dust near the nucleus, the capacity of the dust, and the distribution of dust particles by size. It is held that the distribution by size is the same as in meteoroid showers. The values change within wide ranges for different comets. Author

N70-30790*# Aztec School of Languages, Inc., Maynard, Mass.
BRIGHTNESS VARIATION AND PHOTOMETRIC PARAMETERS OF COMET KILSTON 1966b
G. A. Garazdo-Lesnykh et al *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 152-162 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

Information is given on the observations of Comet Kilston. Photographic (31 estimates) and photo-visual (6 estimates) magnitudes were found. These magnitudes were reduced to the volume of the coma with radius of 25,000 km. The photographic brightness of Comet Kilston was almost invariable. Author

N70-30791*# Aztec School of Languages, Inc., Maynard, Mass.
INVESTIGATIONS OF THE MOVEMENT OF COMETS CARRIED OUT BY THE INSTITUTE OF THEORETICAL ASTRONOMY OF THE ACADEMY OF SCIENCES OF THE USSR, 1963-1966
N. A. Bokhan *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 163-190 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03A

Studies of cometary movements which were carried out during the period of 1963-1966 are reviewed. A brief summary of 37 studies is given. Author

N70-30792*# Aztec School of Languages, Inc., Maynard, Mass.
ALL-UNION CONFERENCE ON THE PHYSICS OF COMETS
V. I. Ivanchuk *In its* Astrometry and Astrophys., No. 4 Jun. 1970 p 191-198 refs (See N70-30776 16-30)
Avail: CFSTI CSCL 03B

A brief review is given of the studies and decisions of the All-Union Conference on the Physics of Comets which was held in Kiev on October 26-29, 1966. Author

N70-30817*# National Aeronautics and Space Administration, Washington, D.C.
THE MOON AS VIEWED BY LUNAR ORBITER
L. J. Kosofsky and Farouk El-Baz (Bellcomm, Inc.) 1970 156 p
(NASA-SP-200) Avail: SOD $7.75; CFSTI CSCL 03B

A selected compilation of Lunar Orbiter photographs are presented which illustrate some of the salient features of the lunar surface. The Orbiter project, the spacecraft and camera systems, and the lunar surface coverage of five missions are described. Four stereoscopic views of selected features and index charts of footprints of all Lunar Orbiter frames are also given. Author

N70-30919*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
ORBITAL IMAGERY FOR PLANETARY EXPLORATION. VOLUME 1: TECHNICAL SUMMARY
D. A. Klopp, comp. Feb. 1970 421 p refs
(Contract NAS2-4494)
(NASA-CR-73450) Avail: CFSTI CSCL 22A

The requirements imposed on spacecraft support subsystem technologies by imaging sensor systems used aboard unmanned planetary orbiters are estimated. The time frame of interest covers launch opportunities from 1975 to 1995, and the targets considered are Mercury, Venus, the Moon, Mars, and Jupiter. By the definition used here, imaging sensors provide two dimensional information, essentially simultaneously, either by rapid scanning or direct two dimensional rewording. Knowledge of demands imposed upon spacecraft support subsystems assists in identifying needs for advanced technology development. These needs are made apparent by comparing required subsystem support with projected subsystem capabilities. This study provides the groundwork for such comparison by estimating the support requirements of planetary orbital imaging experiments. Ranger, Surveyor, Lunar Orbiter, and Mariner mission experience has shown that imaging experiments are likely to impose the most crucial demands on spacecraft subsystems in future unmanned planetary exploration. Thus valuable insight pertaining to necessary subsystem technology development is afforded by considering planetary orbital imaging experiments. Author

N70-30920*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
ORBITAL IMAGERY FOR PLANETARY EXPLORATION. VOLUME 2: DEFINITIONS OF SCIENTIFIC OBJECTIVES
D. A. Klopp, ed. Aug. 1969 175 p refs
(Contract NAS2-4494)
(NASA-CR-73451) Avail: CFSTI CSCL 22A

The scientific objectives of planetary exploration and orbital imaging systems are described briefly. These outlines of planetary composition, structure, and processes, atmospheric composition, structure, and processes, gravitational, magnetic, and electric fields and active and extinct biota information include an objective, observable, definition, phenomena, and possible techniques, and feasibility of remote sensing. S.S.

N70-30921*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
ORBITAL IMAGERY FOR PLANETARY EXPLORATION. VOLUME 3: ORBIT SELECTION AND DEFINITION
J. C. Niehoff and M. L. Hopper Sep. 1969 246 p
(Contract NAS2-4494)
(NASA-CR-73452) Avail: CFSTI CSCL 22C

Quantitative orbit selection results in the form of orbit selection data sheets, and reference data are presented for Mars, Venus, Mercury and Jupiter. Author

N70-30924*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
ORBITAL IMAGERY FOR PLANETARY EXPLORATION: CONDENSED SUMMARY
Feb. 1970 26 p

(Contract NAS2-4494)
(NASA-CR-73449) Avail: CFSTI CSCL 22A

A reiteration of the objectives of orbital imagery for planetary exploration is given in a condensed summary which also contained measurement definitions, orbit selection, imager scaling laws, and experimental support equipment. S.S.

N70-30943*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.
ON SOME ANNEALING CHARACTERISTICS OF HEAVY IONS TRACKS IN SILICATE MINERALS
M. Maurette (CNRS, Orsay, France) May 1969 18 p refs Sponsored in part by McDonnell-Douglas Corp.
(Contract Nas9-8165)
(NASA-CR-110442; SPP-19) Avail: CFSTI CSCL 03B

Thermal annealing of fossil tracks stored in hypersthene crystals of the Johnstown meteorite were studied. It was observed that the annealing of the track desend on their initial length and therefore of the charge of the incident ions. The shortest tracks are annealed at a lower temperature than the longer ones. These long tracks in turn have been found to be less thermally stable on the average than fission fragment tracks. In addition to point out some difficulties in the study of the annealing of heavy ion tracks in solids, the possibility of using thermal annealing experiment is to identify the origins of the tracks stored in naturally or artificially irradiated silicate minerals is discussed. D.G.

N70-31014*# Scientific Translation Service, Santa Barbara, Calif.
ONE OF THE REASONS FOR THE ASYMMETRY OF THE LUNAR SHAPE [ODNA IZ PRICHIN ASIMMETRII RELYEFA LUNA]
J. M. Grigoryev Washington NASA Jun. 1970 11 p Transl. into ENGLISH from Priroda (Moscow), no. 6, 1969 p 90–94
(Contract NASw-2035)
(NASA-TT-F-13038) Avail: CFSTI CSCL 03B

The photography of the other side of the moon, which was first performed by the Soviet Automatic Interplanetary Station Luna-3 reveals the great difference between the shape of the visible side of the moon and the side turned away from us. The reason for this difference is still a puzzle to us. However, it may be assumed that the asymmetrical form results from the prolonged structural development of the natural satellite of the earth. There will probably be many explanations for this. Dissimilar conditions for volcanic activity on the visible and reverse sides of the moon are proposed. This explanation is promising. A concept about the mechanism for the action of volcanos is developed which cannot be unconditionally assumed either for the earth or for the moon. Author

N70-31020*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
JPL DEVELOPMENT EPHEMERIS NO. 69
Douglas A. O'Handley, Douglas B. Holdridge, William G. Melbourne, and J. Derral Mulholland 15 Dec. 1969 41 p refs
(Contract NAS7-100)
(NASA-CR-110451; JPL-TR-32-1465) Avail: CFSTI CSCL 03A

The third issue of JPL Ephemeris Tapes is described, and is designated JPL Development Ephemeris No. 69 (DE 69). It is a special-purpose ephemeris that covers a short time span and does not replace DE 19 as the JPL export ephemeris. These tapes carry the positions and velocities of the planets and of the moon, nutations and nutation rates in longitude and obliquity, and second and fourth modified differences of all these quantities for the interval from October 28, 1961 to January 23, 1976. The description includes discussions of the improvements in the Lunar Ephemeris and the planetary ephemerides made subsequently to the second issue of the JPL Ephemeris Tapes (DE 19). These tapes will be distributed through the NASA Computer Software Management and Information Center (COSMIC). Author

N70-31021*# Translation Consultants, Ltd., Arlington, Va.
SIMILARITY THEORY FOR LARGE-SCALE MOTIONS OF PLANETARY ATMOSPHERES [TEORIYA PODOBIYA DLYA KRUPNOMASSHTABNYKH DVIZHENIY PLANETARNYKH ATMOSFER]
G. S. Golitsyn Washington NASA Jun. 1970 9 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 190, no. 2, 1970 p 323–326
(Contract NASw-2038)
(NASA-TT-F-13140) Avail: CFSTI CSCL 03B

An attempt to construct a closed theory of atmospheric general circulation, using methods of similarity and dimensionality is presented. It is shown for the case of a nonrotating planet that the governing parameters in the equations of atmospheric dynamics can be expressed in the form of one dimensionless combination. It is then found that a number of global characteristics of planetary atmospheric circulations are self-similar with respect to mass, so that from the remaining parameters, combinations with dimensional velocity, time, and energy can be formed. The angular velocity of rotation of the planet is then incorporated into the number of governing parameters. Certain quantitative estimates of the circulation intensity of the atmospheres of Mars and Venus are obtained. Author

N70-31025*# Techtran Corp., Glen Burnie, Md.
A STUDY OF THE POLARIZATION PROPERTIES OF THE SURFACES OF JUPITER AND SATURN [OB ISSLEDOVANII POLYRIZATSIONNYKH SVOYSTV POVERKHNOSTEY YUPITERA I SATURNA]
O. R. Bolkvadze Washington NASA May 1970 7 p refs Transl. into ENGLISH from Tr. Akad. Nauk Kazakhsk. SSR, Astrofiz. Inst. (Alma-Ata), v. 9, 1967 p 38–41
(Contract NASw-2037)
(NASA-TT-F-12904) Avail: CFSTI CSCL 03B

The first results of polarimetric observations of Jupiter and Saturn are reported which were made in 1964 and 1965 at the Abastumani Astrophysical Observatory in the Georgian SSR. The polarization of integral light from the Jovian disk was low and revealed no clear dependence on phase angle. Polarization dependence on phase angle was noted in the polar regions, particularly in the South Polar Region. Polarization of the integral light from the visible disk of Saturn, as well as from individual regions, showed a clear dependence on phase angle. Higher polarization values were recorded for the South Polar Region than for the north region. Author

N70-31028*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.
ACCELERATOR IRRADIATIONS OF MINERALS: IMPLICATIONS FOR TRACK FORMATION MECHANISMS AND FOR STUDIES OF LUNAR AND METEORITIC MATERIALS
M. Seitz, M. C. Wittels, M. Maurette, R. M. Walker, and H. Heckman (Lawrence Radiation Lab., Berkeley, Calif.) May 1969 21 p refs Sponsored in part by McDonnell-Douglas Co.
(Contract NAS9-8165)
(NASA-CR-110439; SPP-18) Avail: CFSTI CSCL 03B

Natural crystals of feldspars, pyroxenes, quartz and apatite were irradiation with neon and argon ions of up to 10.2 MeV/amu. The samples were thinned to thicknesses near 30 microns, stacked to form the target and then bathed completely in the ion beams. X-ray and optical observations revealed: (1) a crystal distortion and curvature with the argon irradiation similar to that produced in mica; (2) a lesser effect from neon bombardment; (3) a fracturing of the crystal samples which depended on the total dose and energy of the incident ion; and (4) polygonized structures produced when either neon or argon ions with sufficiently high concentration were trapped within the crystals. The interpretation of the measurements, their correlation with the mechanism of track

formation and implications concerning the alteration of the lunar surface due to solar particles and the exposure of lunar and meteoritic material in the ancient solar flare cosmic rays are discussed. Author

N70-31029*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE INTEGRABILITY CASES OF THE EQUATION OF MOTION FOR A SATELLITE IN AN AXIALLY SYMMETRIC GRAVITATIONAL FIELD
Abohghassem Ghaffari Feb. 1970 13 p ref
(NASA-TM-X-63945; X-551-70-63) Avail: CFSTI CSCL 22C

The projection of an axially symmetric satellite's orbit on a plane perpendicular to the rotation axis is given by a second-order differential equation where the prime denotes the derivative with respect to x and vinculum psi (x,y) is a known function. Two integrability cases were investigated and it is shown that for the two cases the integration of the given equation can be carried out either by quadratures or reduced to a first-order differential equation. Analytical and physical properties of the equation are expressed, and it is shown that it can be derived from the classical plane eikonal equation of geometric optics. Author

N70-31069*# Scientific Translation Service, Santa Barbara, Calif.
MASS SPECTROMETRIC ANALYSIS OF IONS FROM HIGH-SPEED IMPACT OF DUST PARTICLES
Eberhard Gruen (Ph.D. Thesis—Karl Ruprecht Univ.) Washington NASA Jun. 1970 48 p refs Transl. into ENGLISH from a German dissertation, 1970 53 p
(Contract NASw-2035)
(NASA-TT-F-13086) Avail: CFSTI CSCL 03B

A detector to be used on the German-American Helios project is described. The detector is used to measure the spatial distribution of micrometeorites between 0.3 and 1.0 astronomical units. Spectra were measured in the laboratory using accelerated dust particles and projectiles fired against tungsten, aluminum, gallium and lithium targets. A theoretical analysis of the impact process is given. Author

N70-31155# Addis Translations International, Woodside, Calif.
EMERGENCE OF A SHOCK WAVE INTO AN EXTENDED ENVELOPE OF A STAR AND SUPERNOVA EXPLOSIONS
E. K. Grasberg et al Jan. 1970 29 p refs Transl. into ENGLISH from the Russian Transl. for Calif. Univ., Livermore. Lawrence Radiation Lab.
(UCRL-Trans-10439) Avail: CFSTI

The emergence of a strong shock wave into the atmosphere of a supergiant star is calculated on the basis of hydrodynamic equations in the radiative heat conductivity approximation. The results suggest that the light curves of type 2 supernovae near the maximum can be explained by a thermal mechanism. For this purpose the star must have prior to the explosion an extended atmosphere, which may be due to a transition to the supergiant evolutionary stage or to slow outflow of substance in the pre-supernova stage. The important role played by radiative heat conductivity leads to heating of the atmosphere by a strong thermal wave propagating before the viscosity jump and to the formation of a luminosity maximum before the emergence of the shock wave on the surface. Escape of energy by radiation from the shock front leads to sweeping of the atmospheric matter and to its ejection in the form of a thin, dense shell. Author (NSA)

N70-31182# European Space Vehicle Launcher Development Organization, Paris (France). Engineering Coordination Div.
ACQUISITION UNCERTAINTY AND VISIBILITY FROM A TRACKING STATION
E. Cambi May 1970 23 p
(ELDO-TM-124) Avail: CFSTI

Explicit formulae expressing the expected acquisition errors, in terms of the orbitographic in accuracies and of the relative orientation of the orbit with respect to the tracking station are given. This relative orientation is a function of the orbital elements and of the time after launch due account being taken of the perturbations. The relevant matrix relations are deduced and the conditions for actual visibility are written in terms of the variable parameters i.e. of time after launch. Author (ESRO)

N70-31185# Los Alamos Scientific Lab., N.Mex.
MODEL FOR FORMATION OF SOLAR SYSTEMS FROM MASSIVE SUPERNOVA FRAGMENTS
Wilbur K. Brown 24 Feb. 1970 28 p refs
(Contract W-7405-eng-36)
(LA-4343) Avail: CFSTI

It is hypothesized that each massive fragment will expand and then eventually contract to form a separate solar system. Mathematically, an initial angular momentum distribution is established for the fragment volume, which is then mapped into a mass distribution within a circular disk conserving the angular momentum of each particle during the process. It is found that a right circular cylindrical fragment volume, the faces of which represent the inner and outer surfaces of the shell, yields mass distributions in the disk quite descriptive of the solar system over a wide range of combinations of the parameters involved. The approximate angular momentum of the sun results if the innermost portion of the planetary disk is included in the new sun. If it is further hypothesized that the shell surface breaks up into polygonal areas, the vertices of a resulting polygonal cylinder yield a series of maxima in the form of rings in the planetary disk mass distribution. The characteristic spacing of these rings is quite similar to that of the planets. The gap between Mars and Jupiter, and the orbital tilt of Pluto are intrinsic to the model. Hypotheses are set forth that could account for the low masses and high densities of the minor planets, and for a massive low-angular-momentum Sun. Also presented are speculations based on the model, primarily concerning the peculiarities of the solar system, but including the possible extension of the model to galactic formation. Author (NSA)

N70-31326# National Center for Atmospheric Research, Boulder, Colo.
INSTABILITY OF MAGNETOHYDROSTATIC ATMOSPHERES FROM MAGNETIC BOUYANCY
Peter A. Gilman Jan. 1970 49 p refs Sponsored in part by NSF
(Contract F19628-67-C-0304)
(AD-703737; NCAR-MS-70-6; AFCRL-70-0088; SR-7) Avail: CFSTI CSCL 3/2

Parker (1955) introduced magnetic buoyancy as a possible mechanism for sunspot formation. In this paper, it is shown how magnetic buoyancy can cause instability in horizontally uniform magnetohydrostatic atmospheres. The neutral oscillations in such an atmosphere are examined. TAB

N70-31371# Rome Univ. (Italy). School of Aerospace Engineering.
RECONSTRUCTING TRAJECTORIES [La Restituzione Delle Traiettorie]
P. Santini Dec. 1969 41 p ref In ITALIAN /its Quaderni di Calcolo Elettronico No. 2
Avail: CFSTI

A technique for reconstructing trajectories for use in flight testing rockets and missiles is presented. A typical problem is considered in which the inherent errors are compensated by probability criteria. Mutual interference of two angular components, and terrestrial sphericity are used in this system. Coordinates are derived with respect to time, and data smoothing formulas are indicated. Transl. by F.O.S.

N70-31375*# Translation Consultants, Ltd., Arlington, Va.
WEATHER ON OTHER PLANETS [POGODA NA DRUGIKH PLANETAKH]
G. S. Golitsyn Washington NASA Jun. 1970 11 p refs Transl. into ENGLISH from Zemlya i Vselennaya (USSR), Nov.–Dec. 1969 p 25–30
(Contract NASw-2038)
(NASA-TT-F-13112) Avail: CFSTI CSCL 03B

The probable meteorological conditions on Mars, Venus, and Mercury by interpreting available observational data for these planets in terms of the physical laws governing atmospheric processes on earth are outlined. Diurnal and seasonal variations in wind and temperature characteristics are discussed for Mars and Venus. The possible presence of an atmosphere on Mercury is considered, and the temperature fluctuations are described. Author

N70-31401*# Scientific Translation Service, Santa Barbara, Calif.
PHOTOMETRIC INVESTIGATIONS OF NEBULA NGC 7023 [FOTOMETRICHESKIYE ISSLEDOVANIYA TUMANNOSTI NGC 7023]
A. V. Kurchakov Washington NASA Jun. 1970 14 p refs Transl. into ENGLISH from Issled. (Alma-Ata), v. 11, 1969 p 56–65
(Contract NASw-2035)
(NASA-TT-F-13106) Avail: CFSTI CSCL 03B

The physical characteristics of the NGC 7023 were investigated nebula on the basis of the flux and brightness distribution values obtained with a 500-mm Maksutov-type meniscus telescope at various wavelengths. It is found that the spectral energy distribution in the spectrum of the nebula is too complex to be caused by a single type of particle. As a whole, the energy distribution can be satisfactorily explained by scattering of stellar light at graphite particles coated with ice. Particle sizes and distributions explaining a given polarization value are assessed. Author

N70-31571*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TYPE III SOLAR RADIO BURST STORMS OBSERVED AT LOW FREQUENCIES. PART 2: AVERAGE EXCITER SPEED
Joseph Fainberg and R. G. Stone Jun. 1970 28 p refs Submitted for publication
(NASA-TM-X-63952; X-693-70-209) Avail: CFSTI CSCL 03B

Storms of type III solar radio bursts observed from 5.4 to 0.2 MHz consist of a quasi-continuous production of type III events observable for a half solar rotation but persisting in some cases for well over a complete rotation. The observed burst drift rates are a function of the heliographic longitude of the associated active region. This apparent drift rate dependence is a consequence of the radio emission propagation time from source to observer. Based on this dependence, a least squares analysis of 2500 drift rates between frequencies in the 2.8 to 0.7 MHz range yields an average exciter speed of 0.38c for the height range from approximately 11 to 30 R sub ⊙. In conjunction with the available determinations of exciter speeds of 0.33c close to the sun, and with in situ measurements of 40 keV solar electrons by space probes, the present results suggest that the exciters are electron packets which propagate with little deceleration over distances of at least 1 A.U. Author

N70-31573*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DAYSIDE IONOSPHERE OF VENUS
J. R. Herman, R. E. Hartle, and S. J. Bauer Jun. 1970 47 p refs
(NASA-TM-X-63954; X-620-70-242) Avail: CFSTI CSCL 03B

Theoretical modeling of the daytime Venus ionosphere is used to augment the measurements of Mariner V made during its 1967 flyby of Venus. The equations of heat transport for the electron, ion, and neutral gases are simultaneously solved along with the associated momentum and chemical equations for the ion and neutral gas densities. When solutions are constrained by the observations from Mariner V, the resulting temperature and density profiles can be used to estimate the possible magnetic field strength within the Venus ionosphere and concentration of neutral helium at 100 km altitude. Several alternate models are presented to account for the effects of eddy diffusion in the neutral atmosphere and solar wind heating. In all these models the resulting solutions lead to an approximately horizontal magnetic field in the topside ionosphere of strength 10 - 20 gamma and a neutral helium density of order 10 to the 8th power 0.003 cc at 100 km altitude. Author

N70-31578*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD SPACE FLIGHT CENTER TEST PHILOSOPHY AND RESULTANT RECORD
John H. Boeckel, Albert R. Timmins, and Kenneth R. Mercy Washington Jul. 1970 17 p refs
(NASA-TN-D-5812; G-951) Avail: CFSTI CSCL 22A

This report gives data on two classes of programs: in-house and out-of-house at the flight spacecraft systems test level and on the space performance level. Data on learning curves for multi-launch programs show a continuing need for systems tests of flight hardware. Other data show the time required for minimum thermal-vacuum test is the same for both classes on the order of 13 days. The space record for 73 spacecraft tested has been 95% successful, with in-house tested spacecraft maintaining 100%. Most spacecraft have outlasted their intended life by a significant period, and experiments have been more than 80% productive. Author

N70-31649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL CONTRACTION OF MERCURY
Han-Shou Liu Washington Jun. 1970 11 p refs
(NASA-TN-D-5867) Avail: CFSTI CSCL 03B

The cooling of the planet Mercury would produce a secular decrease of the moment of inertia and accelerate its rotation. It is shown that the initiation of the tidal evolution on Mercury was balanced with the effect of the thermal contraction during the earlier epoch of cooling in a period of about 48 million years. The theory also serves to explain the surface features of Mercury. Author

N70-31654# Air Force Cambridge Research Labs., Bedford, Mass.
GRAPHS OF THE SOLAR DEPRESSION ANGLE FROM 0 DEG TO 32 DEG VS LOCAL HOUR ANGLE FOR LATITUDES 0 DEG TO 90 DEG
Brian P. Sandford and Lawrence R. Doan 8 Dec. 1969 113 p refs Sponsored by DASA
(AD-704141; AFCRL-ERP-309; AFCRL-69-0543) Avail: CFSTI CSCL 4/1

The report presents graphs of local hour angle vs solar depression angles from 0 to 32 degrees for latitudes 0 to 90 degrees. Similar graphs are given in the Air Almanac for solar depression angles to 12 degrees, allowing computations of sunrise to sunset and twilight phenomena up to altitudes of approximately 100 kilometers. The graphs given in this report extend the altitude range of such computations to approximately 1000 kilometers. The tables can also be used for planets and stars, but for the moon considerable error will arise unless corrections for parallax are applied. Author (TAB)

N70-31733*# Brigham Young Univ., Provo, Utah.
MAGNETOMETER DATA ANALYSIS Final Report, 30 Jul.

1969 - 31 May 1970
31 May 1970 9 p ref Prepared for JPL
(Contracts NAS7-100; JPL-952616)
(NASA-CR-110500) Avail: CFSTI CSCL 03B

Progress is reported for work done in the orientation of the interplanetary magnetic field and geomagnetic activity. Partial results for a statistical study of the relationship between flare producing regions on the sun and earth observed cosmic ray variations are given. Statistical relationships among solar wind parameters and between the solar wind and field variables and geomagnetic activity are presented with correlation coefficients. Correlation coefficients are also given for large scale photospheric magnetic fields and the interplanetary magnetic fields as measured by Mariner 5. A method for the investigation of the relationship between the variations in the solar wind parameters and those seen in the brightness temperature of the sun as measured from earth at 9.1 cm wavelength is also included. J.M.C.

N70-31830*# Kansas State Univ., Manhattan. Dept. of Physics.
INFRARED LABORATORY STUDIES OF SYNTHETIC PLANETARY ATMOSPHERES Semiannual Status Report, 1 Dec. 1969 - 31 May 1970
Dudley Williams 1 Jun. 1970 55 p refs
(Grant NGR-17-001-026)
(NASA-CR-110518) Avail: CFSTI CSCL 03B

The results of an investigation of the broadening of individual lines in the CO fundamental by various gases were interpreted in terms of a phenomenonological theory. This theory was applied in detail with considerable success to CO and HCl line broadening in the infrared. It was also found applicable to CO2 and HBr line broadening but failed in certain significant respects when applied to HF. A summary of the theory and its applications is presented. In addition, the development of a high resolution spectrograph for use in the region between 2 microns and 5 microns is reported. The material presented includes: (1) the optical layout of the instrument; (2) certain design details; (3) results obtained with CO at low pressure; (4) results obtained with CO2 at low pressure; and (5) results obtained with methane at low pressure. D.L.G.

N70-31951*# California Inst. of Tech., Pasadena. Div. of Geological Sciences.
[SPACECRAFT INSTRUMENTATION AND OBSERVATIONS FOR THE SPECIAL REFLECTANCE EXPERIMENT OF MARTIAN FROST] Final Report, 1 Oct. 1968 - 31 Mar. 1970
Hugh H. Kieffer Apr. 1970 32 p refs
(Grant NGR-05-002-116)
(NASA-CR-110528) Avail: CFSTI CSCL 03B

Laboratory measurements obtained for spectral reflectance of CO2-H20 frosts are given. A set of improved dewars were built and one of these were fitted into a double-beam photometer which was used for observations. The method of measuring the polar cap reflectance was to scan at a fixed rate completely across Mars from pole to pole using a one second of arc aperture. J.M.C.

N70-31978# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THEORY OF SOLAR RAY RADIO AND X-RAY PULSATION, JANUARY - AUGUST 1969
Y. T. Chiu 1 Feb. 1970 57 p refs
(Contract F04701-69-C-0066)
(AD-704116; TR-0066(5260-10)-3; SAMSO-TR-70-138) Avail: CFSTI CSCL 3/2

The observed modulation of some coronal microwave, X-ray and Type 3 emissions into pulses of 10-sec intervals is a consequence of the stimulation of electron-cyclotron waves propagated in the whistler mode in dipole-like bipolar regions of dimension approximately 0.2 R sub o. Assuming that a power-law spectrum of > or = 10 keV electrons with a slope similar to solar flare protons can be trapped in a bipolar region, it is shown that whistlers can be generated by pitch-angle instability. The resultant approximately 10-sec bounce motion of whistler wave trains leads to enhanced, modulated emission in microwave and X-ray frequencies by pitch-angle scattering of MeV electrons and to modulated Type 3 emission by scattering with coherent plasma waves. A direct prediction of the theory is the existence of sympathetic pulsations at two sources a fraction of a solar radius apart. A second test of the theory is that modulated Type 3 emission should show strong polarization. Author (TAB)

N70-31980 Texas Univ., Austin.
THE DERIVATION OF A GENERAL PERTURBATION SOLUTION AND ITS APPLICATION TO ORBIT DETERMINATION
George Henry Born (Ph.D. Thesis) 1968 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-6119

A first order general perturbation solution is developed for a modified set of Lagrange's planetary equations. The solutions describe the variations with time of a spacecraft's orbit which is perturbed by an arbitrarily shaped primary body and a point mass third body. A set of nonsingular orbit elements is used, therefore, the solutions are valid for all elliptical motion. The solutions utilize Kaula's development of the primary and third body disturbing functions which are expressed in terms of the Keplerian elements. They contain first order short period, long period, and secular effects for both the primary and third body disturbing functions. The accuracy of the solutions is evaluated by comparing results obtained using them with numerically integrated results for Apollo and Lunar Orbiter type orbits. The solutions give an accurate description of the motion during the eight day period considered. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-30603*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
THERMAL PROTECTION SYSTEM ENVIRONMENTS FOR THE MODULAR NUCLEAR VEHICLE, APPENDIX B
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 10 p refs (See N70-30602 16-33)
Avail: CFSTI CSCL 22B

Data and specifications are provided for ambient pressure, vehicle acceleration, acoustic and vibration environments, temperature effects, and radiation environment for tank bottom insulation during liftoff and ascent phases of flight and for Earth orbit, Mars transfer, and Mars orbit. R.B.

N70-30628# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE EQUILIBRIUM SHAPE OF AN ABLATING NOSE IN LAMINAR HYPERSONIC FLOW, FEBRUARY - SEPTEMBER 1969
Franklin D. Hains 31 Dec. 1969 15 p refs
(Contract F04701-69-C-0066)
(AD-702802; TR-0066(5240-10)-9; SAMSO-TR-70-84) Avail: CFSTI CSCL 16/3

A simple theory has been developed to give the equilibrium nose shape of an ablating body in laminar hypersonic flow. The

problem of a lack of body scale, encountered by Simpkins, was overcome in the present theory by using the more accurate heat transfer relation given by Lees. The pressure distribution over the body was assumed to be Newtonian. Comparisons are made between experimental shapes obtained in the Aerospace Corporation arc tunnel and those given by Simpkins. Good agreement is shown except near the shoulder of the body, where the accuracy of the Newtonian formula decreases. The theory shows that the equilibrium shape is more blunt than a hemisphere. Author (TAB)

N70-30652*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THORAD- AGENA PERFORMANCE FOR THE NIMBUS 3 MISSION
Washington Jun. 1970 92 p
(NASA-TM-X-2029; E-5523) Avail: CFSTI CSCL 22A

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N70-30653*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LAUNCH VEHICLE DESCRIPTION
Eugene E. Coffey and Richard P. Geye *In its* Thorad-Agena Performance for the Nimbus 3 Mission Jun. 1970 p 5 - 11 (See N70-30652 15-31)
Avail: CFSTI CSCL 22B

The Thorad-Agena is a two-stage launch vehicle consisting of a Thorad first-stage and an Agena second-stage, connected by a booster adapter. The composite vehicle including the shroud and the booster adapter is about 33 meters (109 ft) long. The total weight at lift-off is approximately 91 625 kilograms (202 000 lbm). The Thorad stage consists of a long-tank Thor and three Castor II solid-propellant rocket motors located 120 deg apart and attached to the long-tank Thor near the aft end. The propellants for the Thorad main engine and the vernier engines are liquid oxygen and high grade kerosene. The propellant for the solid-propellant rocket motors is basically a solid grain of polybutadiene acrylic acid and ammonium perchlorate. The vernier engines, the main engine, and the solid-propellant rocket motors burn for approximately 39 seconds. They are jettisoned at T + 102 seconds in order to insure that the cases for the solid propellant impact in a safe area (water impact). During powered flight, the Thorad main engine is gimbaled for pitch and yaw control, and the vernier engines are gimbaled for roll control. The second stage Agena and the shroud protecting the Nimbus 3 spacecraft are also described. Author

N70-30654*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRAJECTORY AND PERFORMANCE
James C. Stoll *In its* Thorad-Agena Performance for the Nimbus 3 Mission Jun. 1970 p 13 - 19 (See N70-30652 15-31)
Avail: CFSTI CSCL 22D

The Thorad boosts the Agena-Nimbus III onto a prescribed suborbital coast ellipse. Following Thorad-Agena separation, the Agena engine is started and thrusts until it places the Agena-Nimbus III onto a transfer ellipse of 153.72 kilometers (83 n mi) perigee altitude and 1111.20 kilometers (600 n mi) apogee altitude. The Agena-Nimbus III coasts to near the apogee of the transfer ellipse where the Agena engine is restarted. The Agena engine then thrusts for a second time to place the Agena-Nimbus III onto a near-polar circular orbit at an altitude of 1111.20 kilometers (600 n mi). The Nimbus III spacecraft is separated from the Agena about 250 seconds after the Agena engine second cutoff. After Nimbus III separation, the Agena retro-thrust system is operated at two separate times. During the second operation of the retrothrust system, a secondary payload Engineers Geodetic Ranging Satellite (EGRS-13) is separated from the Agena. The two operations of the retrothrust system are performed to insure that the Agena and the EGRS-13 will not interfere with the Nimbus III or with each other during subsequent orbits. The planned ascent profile and orbit configurations for this mission are shown. Author

N70-30655*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THORAD VEHICLE SYSTEM PERFORMANCE
Robert N. Reinberger, Charles H. Kerrigan, Eugene J. Fourney, Howard D. Jackson, James L. Swavely et al *In its* Thorad-Agena Performance for the Nimbus 3 Mission Jun. 1970 p 21 - 40 (See N70-30652 15-31)
Avail: CFSTI CSCL 22B

The systems of the Thorad Launch Vehicle are described, and the system performance is evaluated. All systems were considered to have performed satisfactorily. The systems analyzed include: vehicle structure, propulsion, hydraulic, pneumatic, guidance and flight control, electrical, telemetry, and flight termination. F.O.S.

N70-30656*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AGENA VEHICLE SYSTEM PERFORMANCE
Robert N. Reinberger, Robert J. Schroeder, Howard D. Jackson, Edwin R. Procasky, and Richard L. Greene *In its* Thorad-Agena Performance for the Nimbus 3 Mission Jun. 1970 p 41 - 62 (See N70-30652 15-31)
Avail: CFSTI CSCL 22B

Descriptions of the Agena Rocket Vehicle systems are presented with evaluations of the system performance. The systems analyzed include: vehicle structure, shroud, propulsion, guidance and flight control, electrical, and communication and control. F.O.S.

N70-30657*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LAUNCH OPERATIONS
Alvin C. Hahn *In its* Thorad-Agena Performance for the Nimbus 3 Mission Jun. 1970 p 63 - 64 (See N70-30652 15-31)
Avail: CFSTI CSCL 22D

The prelaunch activities, countdown and launch of the Thorad-Agena-Nimbus 3 satellite are reported. A tabulation of the prelaunch activities is included. F.O.S.

N70-31023# National Aerospace Lab., Tokyo (Japan).
HYBRID SIMULATION OF GUIDED AND CONTROLLED FLIGHT OF ROCKET
Hajime Koshiishi, Masao Naka, Hidehiko Mori, Akira Oishi, Akio Kanmuri et al 1970 25 p refs In JAPANESE; ENGLISH summary
(NAL-TR-189) Avail: CFSTI

It was established that for detailed real time simulations

of guided and controlled flight of rockets, hybrid simulations are desirable. In particular, real time simulations including hardware, for example, sensor or actuator are possible only by hybrid simulations. To perform real time simulation in the pitch plane, we designed and built a so-called balanced-type hybrid simulator, which combined a large-scale analog computer and a large-scale digital computer by an A-D, D-A linkage unit. The equation of rocket dynamics was simplified by reducing it from the equation of six degrees of freedom to the pitch plane equation, on the assumption that the rocket is well controlled in yaw, and Z axis of rocket is always oriented toward the center of the Earth. This simplification is suitable for hybrid simulation and assures a close approximation. Author

N70-31052*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO 13: HOUSTON, WE'VE GOT A PROBLEM
1970 26 p
(NASA-EP-76) Avail: SOD $0.75; CFSTI CSCL 22B

A summary is presented of the aborted Apollo 13 lunar landing mission., caused by an explosion and subsequent loss of power in one of the main electrical circuits of the service module. By using the power system and consumables of the lunar landing vehicle, the crew was able to make the necessary flight corrections and maneuvers for a safe return and reentry to earth. R.B.

N70-31074*# Bellcomm, Inc., Washington, D.C.
DOCKING DYNAMICS SIMULATION FOR AAP
R. J. Ravera 24 Jul. 1969 33 p refs
(Contract NASw-417)
(NASA-CR-110436; TM-69-1022-6) Avail: CFSTI CSCL 22B

An analytical simulation of docking dynamics of two rigid bodies that use the Apollo probe and drogue has been developed. This object of this simulation, called SDOCK, is to analyze a variety of docking problems and obtain accurate trends in a short time. The basic simplicity of the analysis (impulse momentum techniques) and the inherent assumptions lead to some loss of accuracy. However, agreement with more sophisticated analyses and tests is good. The principal results of this study are as follows: It is determined that without axial thrust, miss distances of greater than 0.25 ft will be detrimental to capture; the use of axial thrust on the chase vehicle offers significant improvements in capture probability, especially if the axial thrusters do not have to be shared with attitude control demands; and high probe tip velocity components normal to the drogue surface should be avoided. E.M.C.

N70-31408# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRAVEL OF ROCKETS (SECTION 4 AND 5)
A. A. Dmitrievskii et al 19 Feb. 1970 46 p Transl. into ENGLISH from the Russian
(AD-704008; FTD-MT-24-07-70) Avail: CFSTI CSCL 16/2

The report reviews the capabilities of general purpose and special purpose computers used for solving (missile) flight problems. Based on the nature of the calculated results and the relative time for executing the problems, the application of computers fall into three basic groups: scientific and technical problems in designing, problems in preparing data for the launching of rockets, problems of combat deployment of rocket complexes. A block diagram of a digital electronic computer is included to show the six basic units, and the functions of each unit are elaborated. The sequence (five basic stages) in problem solving are expounded. In solving problems of flight using numerical integration, the Krylov method is described, and a number of special interpolating functions are listed for use in numerical integration; these include those of Newton, Gauss, Bessel, Sterling and Lagrange. The last section of the article deals with the possibilities and designs of electronic analog computers, and the preperation of problems of the flight of rockets using electronic simulation. TAB

N70-31464# Oklahoma State Univ., Stillwater. School of Mechanical Engineering.
ANALYTICAL STUDY TO DETERMINE THE FEASIBILITY OF A RADIANTLY COOLED CRYOSTAT FOR SPACECRAFT Final Report, Sep. 1967 - Aug. 1969
John A. Wiebelt Wright-Patterson AFB, Ohio AFFDL Feb. 1970 53 p refs
(Contract F33615-68-C-1005)
(AD-702940; AFFDL-TR-69-88) Avail: CFSTI CSCL 20/13

The feasibility of using a space radiator at cryostat temperatures was examined in this study. This was done considering an IR detector as the object of cooling and was limited to highly reliable, non-moving, non-degrading radiator and system surfaces. A simple flat surface radiator and enclosure was evolved and analyzed. An attempt at experimental evaluation was made but failed due to mechanical problems. The analytical results indicate that the system proposed could be used to passively cool a detector to temperatures around (230 degrees F-128 degrees K) in a 300 statute mile circular orbit; (175 degrees R-97 degrees K) for a 600 satute mile orbit; and (165 degrees R-92 degrees K) for a 900 statute mile orbit. These temperatures were obtained with common non-degrading aluminized surfaces. Author (TAB)

N70-31513# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ARTILLERY AND ROCKETS: SELECTED CHAPTERS
V. A. Baranyuk 19 Feb. 1970 232 p refs Transl. into ENGLISH from the book "Artilleriya i Rakety" USSR, 1968 232 p
(AD-704166; FTD-MT-24-437-69) Avail: CFSTI CSCL 19/7

Chapter 7 discusses different classes of rockets, trajectories and the kinds of propellants used. Chapter 8 deals with the advantages and disadvantages of Rocket and Tube artillery. Antitank missiles are discussed with a brief history of their use in past wars. In Chapter 9 the authors deal with bballistic rockets and their uses, giving the German V 2 as an example. Chapter 11 goes into combat capabilities of rockets and radiation effects from nuclear warhead explosives. Chapter 12 is devoted to a description of battlefield control of rocket and artillery troops by means of a commanders computer into which all military elements can be programmed. Chapter 14 contains a relatively non technical description of various quantum mechanical devices suitable for military and space adaption. Fundamentals of lasers and their operation are discussed. Military uses of lasers are described. Author (TAB)

N70-31536*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 1: CONDENSED SUMMARY Final Technical Report
31 Oct. 1969 33 p refs
(Contract NAS9-9207)
(NASA-CR-102549; GDC-DCB69-046-Vol-1) Avail: CFSTI CSCL 22B

A conceptual definition of reusable space shuttle systems having multimission capability is presented. The systems as defined can deliver 50,000-pound payloads having a diameter of 15 feet and a length of 60 feet to a 55-degree inclined orbit at an altitude of 270 n.mi. The following types of missions can be accommodated by the space shuttle system: logistics; propellant delivery; propulsive stage delivery; satellite delivery; retrieval, and maintenance; short-duration missions, and rescue missions. Two types of reusable space shuttle systems were defined: a two-element system consisting of a boost and an orbital element and a three-element system consisting of two boost elements and an orbital element. The vehicles lift off vertically using high pressure oxygen/hydrogen rocket engines, land horizontally on conventional runways, and are fully reusable. The boost elements, after staging, perform an aerodynamic entry and fly back to the launch site using conventional airbreathing engines. Author

N70-31537*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 2: FINAL VEHICLE CONFIGURATIONS Final Technical Report
31 Oct. 1969 231 p refs
(Contract NAS9-9207)
(NASA-CR-102550; GDC-DCB69-046-Vol-2) Avail: CFSTI CSCL 22B

A conceptual definition of reusable space shuttle systems having multimission capability is presented. The work accomplished in the final period of Phase A of the Integral Launch and Reentry Vehicle (ILRV) System study is discussed. Two vehicle systems were examined. The vehicles are fully reusable and no hardware is jettisoned. The systems are: (1) FR-3 which is a two element system of asymmetric configuration and (2) FR-4 which is a three element system with the central orbiter element located between the two booster elements. Author

N70-31538*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 3: INITIAL VEHICLE SPECTRUM AND PARAMETRIC EXCURSIONS Final Technical Report
31 Oct. 1969 231 p refs
(Contract NAS9-9207)
(NASA-CR-102551; GDC-DCB69-046-Vol-3) Avail: CFSTI CSCL 22B

The initial vehicle spectrum and parametric excursions of reusable space shuttle systems having a multimission capability are discussed. A flow diagram of the initial vehicle design process is shown. The initial vehicle is synthesized to the given ground rules using inputs to the synthesis program based on preliminary design layouts and experience. The results of this synthesis, based on selected geometry, are packaged in terms of preliminary weight bogies, initial trajectory, and a vehicle layout with preliminary dimensional data. The package is analyzed and a new iteration is developed from which the final vehicle layouts are made. Author

N70-31539*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 4: TECHNICAL ANALYSIS AND PERFORMANCE Final Technical Report
31 Oct. 1969 359 p refs
(Contract NAS9-9207)
(NASA-CR-102552; GDC-DCB69-046-Vol-4) Avail: CFSTI CSCL 22B

The technical analyses used to define the conceptual reusable space shuttle systems with multimission capability are discussed. The purpose of the analysis was to explore various configurational concepts and operational approaches in order to: (1) establish technological feasibility, (2) define potential problem areas, and (3) determine requirements for research and technology development. The aerodynamic data obtained from wind tunnel tests of selected configurations are presented in terms of: (1) reference area and lengths, (2) launch configuration aerodynamics, (3) hypersonic aerodynamics, (4) viscous interation effects, (5) effect of Mach number, (6) subsonic characteristics, (7) cruise engine effects, and (8) tail sizing. The analysis showed that the reusable space shuttle system is a feasible system. Author

N70-31540*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 5: SUBSYSTEMS AND WEIGHT ANALYSIS Final Technical Report
31 Oct. 1969 446 p refs
(Contract NAS9-9207)
(NASA-CR-102537; GDC-DCB69-046-Vol-5) Avail: CFSTI CSCL 22B

The results of subsystem studies and significant characteristics of selected subsystems for conceptual configuration of reusable space shuttle systems are presented. The criteria to which the subsystems must perform and the methods of analysis to permit selection are discussed. Operational characteristics of the selected subsystems are provided to demonstrate compliance with overall vehicle system requirements. All subsystems are described with the exception of propulsion and electronics. Author

N70-31541*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 6: PROPULSION ANALYSIS AND TRADEOFFS Final Technical Report
31 Oct. 1969 158 p refs
(Contract NAS9-9207)
(NASA-CR-102553; GDC-DCB69-046-Vol-6) Avail: CFSTI CSCL 22B

Design, analysis, and tradeoff studies to determine the optimum characteristics of the propulsion subsystems for reusable space shuttle systems are presented. Propulsion functions for the space shuttle are discussed in terms of: (1) boost propulsion, (2) orbit maneuver propulsion, (3) attitude control propulsion, and (4) flyback and landing propulsion. Author

N70-31542*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 7: INTEGRATED ELECTRONICS Final Technical Report
31 Oct. 1969 135 p refs
(Contract NAS9-9207)
(NASA-CR-102554; GDC-DCB69-046-Vol-7) Avail: CFSTI CSCL 22B

The integrated electronics system for reusable space shuttle systems with emphasis on certain limited areas is described. Areas which are covered in detail are: (1) onboard checkout, with emphasis on environmental control/life support and electrical power onboard computer system and associated software, (3) state of the art surveys and technology projections in the areas of display and control and automatic all-weather landing systems, and (4) multiplexed data systems. Author

N70-31543*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 8: MISSION/PAYLOAD AND SAFETY/ABORT ANALYSES Final Technical Report
31 Oct. 1969 220 p refs
(Contract NAS9-9207)
(NASA-CR-102555; GDC-DCB69-046-Vol-8) Avail: CFSTI CSCL 22B

The results of studies involving mission/payload analysis and safety/abort analysis for reusable space shuttle systems are presented. A space shuttle mission traffic schedule and base line and alternate mission descriptions are defined with primary emphasis on the space base/station logistics mission. Detailed main propulsion subsystem and attitude control subsystem requirements are developed for an optimized mission profile. Alternate mission performance sensitivity ground rules are discussed, mission profiles are presented, and alternate mission payload capabilities are assessed. A modular payload concept is developed to satisfy all missions with a minimum number of module configurations. Author

N70-31544*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 9: GROUND TURNAROUND OPERATIONS AND FACILITY REQUIREMENTS Final Technical Report
31 Oct. 1969 83 p refs
(Contract NAS9-9207)
(NASA-CR-102556; GDC-DCB69-046-Vol-9) Avail: CFSTI CSCL 22B

The ground turnaround requirements and terminal facilities for the reusable space shuttle systems having multimission capability are discussed. The ground turnaround and facilities analysis was made with economy of time, manpower, and materials as the primary driving factors. Because of the similarity of reusable

spacecraft operations to airline operations, the experience of the airlines is widely used in determining the procedures and equipment which will provide optimum space shuttle utilization. Author

N70-31545*# General Dynamics/Convair, San Diego, Calif.
SPACE SHUTTLE. VOLUME 10: PROGRAM DEVELOPMENT, COST ANALYSIS, AND TECHNOLOGY REQUIREMENTS Final Technical Report
31 Oct. 1969 247 p refs
(Contract NAS9-9207)
(NASA-CR-102557; GDC-DCB69-046-Vol-10) Avail: CFSTI CSCL 22B

The program development, cost analysis, and technology requirements for the reusable space shuttle systems having multimission capabilities are discussed. The primary function of the development program is to build, test, and demonstrate the capability of the space shuttle design to satisfactorily perform a variety of missions and to attain this capability within a reasonably targeted time span. A description of the methodology used in generating cost estimates for vehicle development investments, and operations programs is presented. The technology program falls into two categories: (1) those that support the space shuttle configuration development and selection and (2) those that are required to support milestone decisions. Author

N70-31575*# TRW Systems Group, Redondo Beach, Calif.
SPACE STORABLE INTER-REGEN DESIGN STUDY Final Report
R. M. Williams 30 Jan. 1970 176 p
(Contract NAS3-12059)
(NASA-CR-72647; TRW-13463-6001-R0-00) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 10740

The Space Storable Inter-Regen Design Study was a six-month analytical and experimental investigation for evaluating selected internally regenerative (inter-regen) cooled thruster design variables using the space storable propellant combination, FLOX/Propane. Several injector and thrust chamber design variables were evaluated at selected coolant flow rates with a basic program goal of demonstrating steady-state thruster operation with minimum performance degradation. Through the use of a ducted-coolant thrust chamber design, steady-state thermal operation was successfully achieved with metallic (copper) chamber designs, during two test firings of 90 and 310 seconds run durations. These tests represent the first unqualified success for the inter-regen RCS thruster cooling concept using the space storable propellants. Author

N70-31579*# National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION: KEY TO THE FUTURE
[1970] 42 p
(NASA-EP-75) Avail: SOD $0.45; CFSTI CSCL 22B

The Space Station and some of its future benefits are described in nontechnical terms taken from information that has been presented at technical conferences. Possible benefits are: (1) detection of large-scale dynamic earth phenonmena such as changes in snow pack, air and water pollution, and occurrences in remote areas; (2) maintenance of meteorological satellites; (3) prospecting for mineral resources; (4) crop condition identification; and (5) locating areas of subterranean water sources. Space station configurations and crew requirements are discussed. F.O.S.

N70-31597*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
A TWO-STAGE FIXED WING SPACE TRANSPORTATION SYSTEM. VOLUME 1: CONDENSED SUMMARY Final Report
(Contract NAS9-9204)
(NASA-CR-102086; MDC-E0056-Vol-1) Avail: CFSTI CSCL 22B

Results of a study on a two stage fixed wing space transportation system are summarized. This study was undertaken to provide verification of the feasibility and effectiveness of the MSC in-house studies and provide design improvements, to increase the depth of engineering analyses, and to define a development approach. Technical analysis and design results indicate that this concept is a viable configuration. Author

N70-31598*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
A TWO-STAGE FIXED WING SPACE TRANSPORTATION SYSTEM. VOLUME 2: PRELIMINARY DESIGN Final Report
15 Dec. 1969 243 p refs
(Contract NAS9-9204)
(NASA-CR-102087; MDC-E0056-Vol-2) Avail: CFSTI CSCL 22B

The growth of future manned space exploration is dependent upon the development of a reusable space transportation system with operational practices similar to present day aircraft procedures. Such a system could achieve a dramatic reduction of operational costs and allow a rapid expansion of space flight. A two stage configuration satisfying these requirements has been conceived in which both the orbiter and booster have fixed wings and tail and look similar to conventional aircraft. The fixed wing provides good subsonic cruise and horizontal landing characteristics which are very similar to present day high performance aircraft. Designs of both stages incorporate conventional structural design techniques. The fixed wing is of conventional construction, except for the heat protection. The fuselage uses an integral tank structure with associated frames to pick up the concentrated loads. The fan cruise engines are fixed in the forward fuselage which aids in balancing the vehicle and simplifies the installation. The primary heat protection is provided by silica cloth faced hardened insulation and pyrolized carbon laminate composite. Author

N70-31599*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
A TWO-STATE FIXED WING SPACE TRANSPORTATION SYSTEM. VOLUME 3: MASS PROPERTIES Final Report
15 Dec. 1969 43 p
(Contract NAS9-9204)
(NASA-CR-102088; MDC-E0056-Vol-3) Avail: CFSTI CSCL 22B

Efforts have been directed toward defining a realistic and achievable weight for the specific points design undertaken. Initial work was on a 12,500 pound payload vehicle which was worked in detail. Later efforts turned to a 25,000 pound payload vehicle. Initial sizing of this vehicle was based upon parametric analysis of the 12,500 pound vehicle. Again a detail point design was pursued to insure that the configuration mass properties were adequately defined and achievable. Results of this work show: (1) Careful attention must be given to the structural details to minimize weight in body structure, wing, tails, and landing gear. (2) Minimum weight approaches must be used in the thermal protection system with particular care given to shingle attachment to the body. (3) Propulsion feed systems, pressurization systems, engines, and gimbal systems must be minimized from a weight viewpoint. (4) Remaining systems do not drive the design. (5) Careful packaging must be done to meet center of gravity requirements. Author

N70-31610*# Martin Marietta Corp., Denver, Colo.
RESPONSE OF FLEXIBLE SPACE VEHICLES TO DOCKING IMPACT. VOLUME 1: ANALYTICAL INVESTIGATION, 4 APRIL 1968 - 3 MARCH 1970
Carl S. Bodley and A. Colton Park Mar. 1970 118 p refs
(Contract NAS8-21280)
(NASA-CR-102622; MCR-70-2-Vol-1) Avail: CFSTI CSCL 22B

The analytically predicted influence of a docking mechanism on two flexible space vehicles engaged in a docking maneuver is investigated. The mathematical formulation of the this maneuver considers the docking of a chase vehicle to a target vehicle; the docking mechanism is of the probe/drogue type currently planned for the Apollo Applications Program. The docking mechanism serves to dissipate the relative kinetic energy of the docking vehicles, to

provide a means of achieving attitude alignment, and to draw the vehicles together and allow a hard structural connection. The formulation of the analysis considers the docking vehicles to be under the influence of one or more control systems. The mathematical model was programmed for numerical evaluation of the docking response. Primary program output is presented as time history plots of significant variables including vehicle velocities, probe/drogue deformation characteristics, interface forces and moments, and important control system parameters. Numerical results for 12 demonstration cases illustrate the versatility of the digital program and the output format. For Vol. 2 see N70-25587. Author

N70-31641*# Martin Marietta Corp., Denver, Colo.
STUDY FOR CLEANLINESS LEVEL REQUIRMENTS FOR PNEUMATIC AND HYDRAULIC COMPONENTS: SERVICE ARM SYSTEMS, COMPLEX 39 Final Report
Sep. 1969 350 p refs
(Contract NAS10-5935)
(NASA-CR-110519; MCR-69-484; KSC-TR-1057) Avail: CFSTI CSCL 22D

Analytical and experimental studies are discussed to determine the minimum cleanliness levels required for the pneumatic and hydraulic systems on the Launch Complex 39 Service Arms. The study encompassed a comprehensive system review, a critical analysis of components with respect to contamination, a literature/industry search to compile pertinent data and experience, and a test program to demonstrate component functional compliance versus contamination. Author

N70-31659# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENTIFIC RESULTS FROM THE FLIGHT OF YANTAR AUTOMATIC IONOSPHERE LABORATORIES, PART 2
L. A. Artsimovich et al 30 Jan. 1970 16 p refs Transl. into ENGLISH from the Russian
(AD-704045; FTD-HT-23-637-69) Avail: CFSTI CSCL 22/2

To investigate the prospects of controlled flight in the upper atmosphere, Yantar automatic ionospheric laboratories with gas plasma ion engines were launched by means of geophysical rockets to altitudes of 100-400 km. The complicated interaction of a gas ion jet and a neutralizer (electron emitter) with the plasma of the ionosphere is studied. The data from processing the results obtained in the experiments are given in the report. TAB

N70-31822*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE. VOLUME 1: CONFIGURATION DEFINITION AND PLANNING. PART A: SECTIONS 1-9 Final Report
Wilson B. Schramm 22 Dec. 1969 546 p refs
(Contract NAS9-9206)
(NASA-CR-102543; LMSC-A959837-Vol-1-Pt-A) Avail: CFSTI CSCL 22B

The Integral Launch and Reentry Vehicle Study is presented. The General objectives of the study were to assess technical feasibility, performance, and cost for development of reusable earth-orbital transportation systems that provide potential for an order of magnitude reduction in operating costs. A specific objective was to define baseline Space Shuttle configurations to perform the crew and passenger and logistics transport mission to support the large NASA Space Stations planned in the late 1970s and 1980s. The Space Shuttle, as presently conceived, is a versatile multimission vehicle system, based entirely on advanced liquid hydrogen and oxygen propulsion, with the capability of delivering 50,000 pounds to the nominal Space Station orbit at 270 nm and 55 degree inclination and returning to earth intact. The recommended vehicle design approach calls for a blend of advanced rocket and aircraft development techniques in a fully reusable Two-Stage configuration, consisting of an orbiter spacecraft and a flyback booster. Author

N70-31823*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE. VOLUME 1: CONFIGURATION DEFINITION AND PLANNING. PART B: SECTIONS 10-17 Final Report
Wilson B. Schramm 22 Dec. 1969 274 p refs
(Contract NAS9-9206)
(NASA-CR-102569; LMSC-A959837-Vol-1-Pt-B) Avail: CFSTI CSCL 22B

The electrical power; guidance, navigation, and control; communications; and data management systems for the integral launch and reentry vehicle are discussed. Electrical power during all phases from liftoff through final landing is supplied by a system of fuel cells and emergency batteries on the orbiter and by primary batteries on the booster. The high mechanical power requirements of both stages associated with high rate actuation of aerodynamic control surfaces are supplied by a chemical turbine-driven system during the reentry and landing phases. Author

N70-31824*# Lockheed Missiles and Space Co., Sunnyvale, Space Systems Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE. VOLUME 2: TECHNOLOGY IDENTIFICATION Final Report
Wilson S. Schramm 22 Dec. 1969 71 p refs
(Contract NAS9-9206)
(NASA-CR-102573; LMSC-A959837-Vol-2) Avail: CFSTI CSCL 22B

The technologies required for design and construction of integral launch and reentry vehicles are presented. Specific subjects discussed are: (1) propulsion systems, (2) aerodynamics, (3) aerothermodynamics, (4) structures, (5) avionics, (6) bioastronautics, and (6) technology development. Author

N70-31825*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE. VOLUME 3: SPECIAL STUDIES. PART A: SECTIONS 1-3 AND APPENDIX A Final Report
22 Dec. 1969 205 p refs
(Contract NAS9-9206)
(NASA-CR-102630; LMSC-A959837-Vol-3-Pt-A) Avail: CFSTI CSCL 22B

The propulsion system parameters and propulsion/vehicle interfaces for the integral launch and reentry vehicle are discussed. Propulsion system parameter studies included thrust-level considerations, engine-configuration effects, and orbital operation mode. Propulsion/vehicle interface studies were associated with the establishment of rocket-engine criteria for the engine system specification. Both the aerospike and bell-type engines were examined in various phases. Two configurations considered were a two-stage arrangement and a dissimilar triamese arrangement. Payload, liftoff weight, and stage weight specifications were established. Author

N70-31826*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE. VOLUME 3: SPECIAL STUDIES. PART B: SECTIONS 4 AND 5 AND APPENDIXES B, C, AND D Final Report
Wilson B. Schramm 22 Dec. 1969 317 p refs
(Contract NAS9-9206)
(NASA-CR-102629; LSMC-A959837-Vol-3-Pt-B) Avail: CFSTI CSCL 22B

The integrated electronics system for the integral launch and reentry vehicle is described. The system is defined as all

equipment employing electronics to sense, acquire, generate, transmit, process, store, record, or display data required for the operation of any and all vehicle systems, for determining their operational and flight safety status, and for performing onboard launch control and mission control operations. Avionics may also include equipment required for electrical power development and energy storage, power control, and power distribution. Author

N70-31831*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE: EXECUTIVE SUMMARY Final Report
Wilson B. Schramm 22 Dec. 1969 32 p
(Contract NAS9-9206)
(NASA-CR-102574; LMSC-A9598-7) Avail: CFSTI CSCL 22B

To meet the projected national space transport requirements, a Two-Stage fully reusable launch system, based on advanced hydrogen-oxygen propulsion systems, has been derived in the study. The booster is comparable in size and weight to the C-5A aircraft, and the lifting body orbiter incorporates a propulsion system comparable to the Saturn S-11 stage. As alternate designs were investigated, several candidate systems were eliminated. Two principal concepts were investigated initially in the study. In one, the Stage-and-One-Half, a single orbiting stage and low cost drop tanks are featured. In the other, the pure Triamese, commonality of orbiter and booster primary structure and propulsion systems was adopted. The objective in both concepts was to eliminate a spearate parallel booster development program. Author

N70-31832*# North American Rockwell Corp., Downey, Calif. Space Div.
STUDY OF INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 1: SUMMARY, PHASE 2 Final Report
Dec. 1969 28 p
(Contract NAS9-9205)
(NASA-CR-102102; SD-69-573-1) Avail: CFSTI CSCL 22B

Future space exploration will be constrained within a limited budget and will benefit from the development of an economical logistic system. NASA is therefore directing investigations of reusable logistic vehicles which offer potential for major operational cost reduction compared to current systems. Results of design, performance, and resource studies are presented. The major objectives of the study were to define logistic systems which achieve an order of magnitude reduction in recurring costs and to advance inherent safety. The program was divided into two phases: the first phase encompassed comparison of logistic vehicle concepts using expendable boosters. The second phase encompassed investigations of a two state reusable vehicle conceived by NASA/MSC. This vehicle has similar shaped booster and orbiter elements with fixed low sweep wings and the main propulsion system uses LO2/LH2 propellants. In the study, vehicles were configured to deliver 10,000-, 25,000-, and 50,000-pound payloads to a 270 nautical mile altitude, 55 degree inclination orbit. A conceptual design definition was prepared for a selected vehicle, and the technology required to support development of the system was identified. Author

N70-31833*# North American Rockwell Corp., Downey, Calif. Space Div.
STUDY OF INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 2: TECHNOLOGY DEVELOPMENT REQUIREMENTS Final Report
Dec. 1969 34 p
(Contract NAS9-9205)
(NASA-CR-102106; SD-69-573-2) Avail: CFSTI CSCL 22B

Future space exploration will be constrained within a limited budget and will benefit from the development an economical logistic system. NASA is therefore directing investigations of reusable logistic vehicles which offer potential for major operational cost reduction compared to current systems. Technology required for development of the advanced reusable space shuttle vehicle concept is discussed. The major objectives of the study were to define logistic systems which achieve an order of magnitude reduction in recurring costs and advance inherent safety. The program was divided into two phases. The first phase encompassed comparison of logistic vehicle concepts using expendable boosters. The second phase encompassed investigations of a two stage reusable vehicle conceived by NASA MSC. This vehicle has similarly shaped booster and orbiter elements with fixed, low sweep wings, and the main propulsion system uses LO2/LH2 propellant. In the study, vehicles were configured to deliver 10,000-, 25,000-, and 50,000-pound payloads at a 270 nautical mile, 55 degree inclination orbit. A conceptual design definition was prepared for a selected vehicle, and the technology required to support development of the system was identified. Author

N70-31834*# North American Rockwell Corp., Downey, Calif. Space Div.
STUDY OF INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 3: TECHNICAL REPORT, PHASE 2: ENVIRONMENT AND PERFORMANCE Final Report
Dec. 1969 521 p refs
(Contract NAS9-9205)
(NASA-CR-102103; SD-69-573-3) Avail: CFSTI CSCL 22B

Future space exploration will be constrained within a limited budget and will benefit from the development of an economical logistic system. NASA, therefore, is directing investigations of reusable logistic vehicles that offer potential major operational cost reductions compared with costs of current systems. Among these investigations is the Study of Integral Launch and Reentry Vehicle Systems. This document contains results of design, performance, and resource studies. The major objective of the study was to define logistic systems that achieve an order of magnitude reduction in recurring costs and that advance inherent safety. The program was divided into two phases: the first phase encompassed comparison of logistic vehicle concepts using expendable boosters. The second phase encompassed investigations of a two stage reusable vehicle conceived by NASA MSC. In the study, vehicle were configured to deliver 10,000-, 25,000-, and 50,000-pound payloads to a 270-nautical mile, 55-degree inclination orbit. Vehicles to deliver 25,000 and 50,000 pound payloads were designed. Author

N70-31835*# North American Rockwell Corp., Downey, Calif. Space Div.
STUDY OF INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 4: TECHNICAL REPORT, PHASE 2: DESIGN AND SUBSYSTEMS ANALYSIS Final Report
Dec. 1969 86 p
(Contract NAS9-9205)
(NASA-CR-102105; SD-69-573-4) Avail: CFSTI CSCL 22B

Future space exploration will be constrained within a limited budget and will benefit from the development of an economical logistic system. NASA, therefore, is directing investigations of reusable logistic vehicles that offer potential major operational cost reductions compared with costs of current systems. Among these investigations is the Study of Integral Launch and Reentry Vehicle System. This document contains results of design, performance, logistic systems that achieve an order to magnitude reduction in recurring costs and that advance inherent safety. The program was divided into two phases: the first phase encompassed comparison of logistic vehicle concepts using expendable boosters. The second phase encompassed investigations of a two stage reusable vehicle conceived by NASA MSC. In the study, vehicles were configured to deliver 10,000, 25,000 and 50,000 pound payloads to a 270 nautical mile, 55 degree inclination orbit. Author

N70-31836*# North American Rockwell Corp., Downey, Calif. Space Div.
STUDY OF INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 5: TECHNICAL. PHASE 2: OPERATIONS AND RESOURCES Final Report
Dec. 1969 286 p
(Contract NAS9-9205)
(NASA-CR-102107; SD-69-573-5) Avail: CFSTI CSCL 22B

For Abstract, see N70-31835.

N70-31857# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIETS ORBIT SATELLITE-KILLER
25 Feb. 1970 7 p Transl. into ENGLISH from report 'Novoe Russkoe Slovo' USSR, 7 Feb. 1970 p 1
(AD-703885; FTD-HT-23-141-70) Avail: CFSTI CSCL 22/2

The Soviet Union is said to have developed a new and powerful space weapon. US and British space experts claim that Soviet engineers have succeeded in producing an artificial Earth satellite capable of intercepting and destroying space craft and vehicles in orbital flight around the Earth. TAB

N70-31884*# Chrysler Corp., New Orleans, La. Space Div.
EVALUATION OF HYDROGEN/FLUORINE/LITHIUM, HYDROGEN/FLUORINE, AND HYDROGEN-LITHIUM/FLUORINE UPPER STAGES
25 Jul. 1970 245 p refs
(Contract NASw-1965)
(NASA-CR-110530; TR-AE-70-29) Avail: CFSTI CSCL 22B

The requirements for integrating the tripropellant Li/F2/H2 into a complete stage was investigated and the resultant performance capabilities were determined. The methods are described, and performances of the tripropellant the F2/H2 upper stages are compared. The results of sensitivity studies for the thermal and meteoroid protection systems are also presented. The following conclusions were reached: The tripropellant stage shows no significant payload advantage over the F2/H2 bipropellant stage for direct injection missions. The tripropellant stage is not as attractive as an F2/H2 state for missions involving a long coast. The tripropellant and gel stages have comparable performance for direct injection missions. The gel stage is superior to the tripropellant stage and comparable to the bipropellant stage for missions with a long coast. The use of slush hydrogen results in significant payload gains for all stages and missions. Author

N70-31891*# Fairchild Hiller Corp., Farmingdale, N.Y.
HOUSEKEEPING CONCEPTS FOR MANNED SPACE SYSTEMS: MID-TERM REPORT PRESENTATION
26 Jun. 1970 59 p
(Contract NAS9-10662)
(NASA-CR-108515; MS124Y0001) Avail: CFSTI CSCL 22B

Illustrations are presented for waste disposal concepts in manned space systems. The study is divided into study tasks, surveys, waste definition, waste utilization, waste disposal pretreatment, waste disposal, waste handling and housekeeping, computer data, and recommendations. Relationships between manned space systems and submarine habitability are compared. R.B.

N70-31943*# Martin Marietta Corp., Denver, Colo.
FLIGHT PACKAGED ONBOARD CHECKOUT SYSTEMS DEVELOPMENT UNIT Final Report
18 May 1970 97 p
(Contract NAS9-8000)
(NASA-CR-108487; MCR-70-120) Avail: CFSTI CSCL 22B

The design, development, fabrication and test of a flight packaged On Board Checkout Set (OCS), is documented. There were four areas requiring significant development: a comprehensive set of interactive airborne computer programs, an airborne alpha-numeric display device, large scale airborne computer, and an on-board maintainable airborne packaging concept. These were resolved by a Near English test community language called Pi-EP spaceborne computer, and a packaging concept allowing the functional module to be easily removed or placed on the spacecraft wall via a cam latching apparatus. Author

N70-31988*# Grumman Aerospace Corp., Bethpage, N.Y.
DESIGN AND FABRICATION OF WHEELS FOR A LUNAR SURFACE VEHICLE. VOLUME 2: PROPOSED TEST PLAN Final Report
Jun. 1970 22 p
(Contract NAS8-25193)
(NASA-CR-102748) Avail: CFSTI CSCL 22B

Outlined is a comprehensive test program designed to qualify a wheel drive assembly for use on the lunar surface. The plan is designed specifically for a conical fiberglass wheel concept, however, the test philosophies, requirements, and proposed procedures are adaptable to any wheel drive assembly. The NASA sponsored Dual Mode Lunar Roving Vehicle study recently completed was used as a primary reference to establish basic test requirements, and is referenced frequently herein. The plan is based on the availability of three wheel drive assemblies, and encompasses static testing mobility performance, and endurance tests under various environmental conditions. Author

N70-31989*# Grumman Aerospace Corp., Bethpage, N.Y.
DESIGN AND FABRICATION OF WHEELS FOR A LUNAR SURFACE VEHICLE. VOLUME 1: DETAILED TECHNICAL REPORT Final Report
Jun. 1970 130 p refs
(Contract NAS8-25193)
(NASA-CR-102755) Avail: CFSTI CSCL 22B

A single element elastic conical wheel was evolved through an extensive design and test program addressed to resolving the lunar mobility problem. The objective of this study was to refine the existing conical wheel design in order to provide an optimum configuration compatible with the NASA defined Dual Mode Lunar Roving Vehicle (DLRV) mission requirements. The unique wheel form does not allow the normal analytic analyses techniques therefore an empirical test program was used to evolve an optimum design. Because of the interrelated nature of the previous testing and the DLRV concepts, prior data which was felt to be pertinent to the final design selection shown herein has been included in this report.

Three wheels of the final design have been provided to NASA for testing. A proposed lunar qualification test plan is provided for the entire wheel drive assembly. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-30634# Aerospace Corp., El Segundo, Calif. Lab. Operations.
STRESS WAVE DISPERSION IN ROD-REINFORCED COMPOSITES, JANUARY - JULY 1969
John P. Jones 30 Jan. 1970 37 p refs
(Contract F04701-69-C-0066)
(AD-702801; TR-0066(5240-30)-3; SAMSO-TR-70-81) Avail: CFSTI CSCL 11/4

A dispersion model to calculate the distortion of stress pulses in a fiber-reinforced composite where the fibers are considerably

stiffer than the matrix is postulated. The governing equations for a simple, approximate theory are derived and compared with the results of a similar calculation, using the exact geometry with the linear theory of elasticity. Possible extensions of the approximate theory are discussed. Author (TAB)

N70-30637# Bell Aerosystems Co., Buffalo, N.Y.
APPROXIMATE SOLUTION OF PLANE ORTHOTROPIC ELASTICITY PROBLEMS Final Report, Apr. 1968 - Oct. 1969
Joel Schimke, Kevin Thomas, and John Garrison Jan. 1970 367 p refs
(Contract F33615-68-C-1560)
(AD-702875; AFFDL-TR-69-84) Avail: CFSTI CSCL 20/11

The purpose of this study is to compare and evaluate a number of approximate methods for the solution of plane orthotropic elasticity problems. The methods under consideration fall into three main categories. The first category is perturbation methods, which are based on the assumption that the behavior of the orthotropic material under a particular loading is not greatly different than the behavior of some nearby isotropic material under the same loading. The second category is the so-called boundary residual methods. In these techniques the assumed families of functions are required to satisfy all the equations of elasticity internally but none of the boundary conditions. The boundary conditions are then satisfied approximately in accordance with the particular boundary residual criterion under consideration. The two criteria that are examined in this report are the integral least squares and boundary Reissner energy methods. The third category of approximate methods is that for which the assumed functions may have to satisfy some, but not all, of the equations of elasticity internally and certain of the boundary conditions. The other equations of elasticity and the other boundary conditions (if any) are then satisfied approximately in accordance with the particular method. Author (TAB)

N70-30659# Brown Univ., Providence, R.I. Center for Dynamic Systems.
INSTABILITY OF A VISCOELASTIC CANTILEVER UNDER A FOLLOWER LOAD
Raymond H. Plaut 1970 13 p refs
(Contract N00014-67-A-0191-0009)
(AD-702764) Avail: CFSTI CSCL 13/18

This report is concerned with the stability of a viscoelastic cantilevered column which is subjected to a retarded follower load at its free end. Author (TAB)

N70-30697*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRESS CONCENTRATIONS IN FILAMENT-STIFFENED SHEETS
Wilbur Bryan Fichter (Ph.D. Thesis—North Carolina State Univ., Raleigh) 1969 83 p refs
(NASA-TM-X-62992) Avail: CFSTI CSCL 20K

An influence-function technique is employed to analyze the stresses and deformations due to flaws in an idealized composite material composed of parallel, equally spaced, tension-carrying filaments embedded in a shear-carrying matrix. Static tensile stress concentration factors are obtained for the cases of two equal-length transverse collinear cuts across various numbers of filaments, and for the case of a periodic array of transverse collinear cuts. In addition, a static shear stress concentration factor is obtained for a single cut across an arbitrary number of consecutive filaments. Dynamic stress concentration factors are obtained for two cases in which two collinear cuts are suddenly introduced into a stretched filamentary sheet. Matrix shear loads are investigated and their variation in the longitudinal direction is studied for several cases involving single and double cuts. In addition, loads in broken filaments are calculated for some single-cut cases, and their implications for an existing statistical tensile failure analysis for composite materials are briefly discussed. Author

N70-30848*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STRAIN ANALYSIS TECHNIQUE FOR LARGE DEFORMATIONS BASED ON THE OPTICAL PROPERTIES OF A THIN METALLIC FILM DEPOSITED ON A STRUCTURAL SUBSTRATE
Jerry Gene Williams (Ph.D. Thesis—Virginia Polytechnic Inst.) May 1970 138 p refs
(NASA-TM-X-62991) Avail: CFSTI CSCL 20K

The optical response to loading of a thin metallic film deposited on a low modulus structural substrate is studied both analytically and experimentally. Two fundamental types of transmittance and reflectance properties are shown to be related to the mechanical state of the substrate. An analytical approach is developed to relate the optical properties of the metallic film to the mechanical properties of the substrate. A set of empirical optical-mechanics relationships are proposed between the total and central image transmittance and reflectance properties and the strain field of a general biaxial problem. Experimental results are presented for the total and central image transmittance response for thin films of aluminum, copper and indium deposited on a silicone rubber substrate subjected to uniaxial loading. Microscopic surface examinations of gold, aluminum and indium on a silicone rubber substrate clearly demonstrate the characteristic microfracture and wrinkle geometric patterns. Author

N70-30926*# Techtran Corp., Glen Burnie, Md.
INVESTIGATIONS OF SUPERCRITICAL DEFORMATIONS OF RIBBED CYLINDRICAL SHELLS SUBJECTED TO AXIAL COMPRESSION [ISSLEDOVANIE ZAKRITICHESKIKH DEFORMATSIY REBRISTYKH TSILINDRICHESKICH OBOLOCHEK, PODVERZHENNYKH OSEVOMU SZHATIYU]
A. A. Pryadko Washington NASA Jun. 1970 10 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 9, 1969 p 34-39
(Contract NASw-2037)
(NASA-TT-F-12954) Avail: CFSTI CSCL 20K

The supercritical deformations of ribbed cylindrical shells subjected to axial compression is examined. A ribbed closed cylindrical shell subjected to axial compression applied in the form of compressive stresses distributed on the ends of the shell is considered. The shell is reinforced by both longitudinal and circular ribs. The upper and lower critical stresses are determined. The expressions obtained for this purpose are complex, but a simplified form for determining these values is presented; both general and special cases are examined. Author

N70-30927*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE DYNAMIC CHARACTERISTICS OF A SOLID BODY WITH A CYLINDRICAL CAVITY, PARTIALLY FILLED WITH A VISCOUS LIQUID [ISSLEDOVANIYE DINAMICHESKIKH KHARAKTERISTIK TVERDOGO TELA S TSILINDRICHESKOY POLOSTYU, CHASTICHNO ZAPOLNENNOY VYAZKOY ZHIDKOSTYU]
B. I. Rabinovich et al Washington NASA Jun. 1970 14 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 9, 1969 p 11-19
(Contract NASw-2037)
(NASA-TT-F-12953) Avail: CFSTI CSCL 20K

The dynamic characteristics of a solid cylindrical body containing a cavity partially filled with a viscous liquid (water and glycerine mixture) are analyzed through boundary value problems. Equations are developed whose amplitude-frequency curves are shown to be very similar to experimental ones, so that they constitute a sufficiently accurate description of the motion of the model. Author

N70-30929# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

STABILITY OF DIFFERENCE APPROXIMATION TO SHOCK WAVE PROPAGATION IN INHOMOGENEOUS ELASTIC-PLASTIC MEDIA

Yoshisuke Nakano Dec. 1969 16 p
(AD-700996; CRREL-RR-277) Avail: CFSTI CSCL 20/11

An analysis is made of the stability of difference approximation to one-dimensional shock wave propagation in elastic-plastic media. The necessary condition for stability is obtained. Author (TAB)

N70-30944*# Techtran Corp., Glen Burnie, Md.
DAMPING OF VIBRATIONS IN CYLINDRICAL SHELLS OF GLASS AND PLASTIC [ZATUCHANIYE KOLEBANIY V STEKLOPLASTIKOVYKH TSILINDRICHESKIKH OBOLOCHKAKH]

A. A. Bondarenko et al Washington NASA Jun. 1970 6 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 9, 1969 p 121-124
(Contract NASw-2037)
(NASA-TT-F-12956) Avail: CFSTI CSCL 20K

External losses were held to a minimum by setting the amplitudes of the radial displacements of a glass and plastic cylinder at resonant frequencies. The damping coefficient of such a shell exceeds analogous values for a steel shell by a factor of approximately 15. Author

N70-31033# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
AXISYMMETRIC BUCKLING OF HOLLOW SPHERES AND HEMISPHERES

Louis Bauer, Edward L. Reiss, and Herbert B. Keller (California Inst. of Tech.) Dec. 1969 102 p refs
(Contracts AT(30-1)-1480); N00014-67-A-0467-0008)
(IMM-379; NYO-1480-132) Avail: CFSTI

A nonlinear thin shell theory is derived for the axisymmetric buckling of spherical shells subjected to either a pressure or a centrally directed surface load. The theory is reduced to a boundary value problem for a system of four first order ordinary differential equations. Numerical solutions of this boundary value problem are obtained by the shooting and parallel shooting methods. An extensive numerical study is made of the nonlinear deformations of the shells. For example, it is found that all solution branches that bifurcate from the eigenvalues of the linearized buckling theory are connected to each other by means of intermediate branches. Some implications of the numerical results concerning the buckling of spherical shells are discussed. Author

N70-31041# Boeing Co., Renton, Wash. Commercial Airplane Div.
SAMECS STRUCTURAL ANALYSIS SYSTEM: USER'S DOCUMENT

Norman Connacher, M. Mc Elroy, and Stanley D. Hansen 21 Feb. 1969 231 p
(AD-702472; D6-23757-1-TN) Avail: CFSTI CSCL 1/3

The purpose of the manual is to provide the users of the SAMECS program with all information required for producing the input data card deck and interpreting the program output. It is assumed that the user has a basic understanding of the direct stiffness method of structural analysis, structural idealization methods and elementary matrix algebra and, hence no attempt has been made to educate the reader in these complicated areas. The manual is intended to be a handbook rather than a text and should be used as a reference work for the input and output characteristics of the SAMECS program. Author (TAB)

N70-31061*# North American Rockwell Corp., Downey, Calif. Space Div.
RADIAL AND AXIAL TRANSMISSIBILITY CHARACTERISTICS OF TYPICAL ROCKET VEHICLE STRUCTURE Technical Summary Report

Stuart Y. Lee Dec. 1969 431 p refs
(Contract NAS8-21426)
(NASA-CR-102725; SD-69-766) Avail: CFSTI CSCL 20K

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1. INTRODUCTION p 1-4

2. FREQUENCY AND MODAL ANALYSES BY SERIES-EXPANSION TECHNIQUE p 5-13 (See N70-31062 16-32)

3. FREE-VIBRATION ANALYSES BY FINITE-ELEMENT APPROACH p 15-28 (See N70-31063 16-32)

4. SHOCK AND FORCED VIBRATION ANALYSES p 29-57 (See N70-31064 16-32)

5. EXPERIMENTAL INVESTIGATION p 59-80 (See N70-31065 16-32)

6. COMPARISON AND CORRELATION OF EXPERIMENTAL RESULTS p 81-98 refs (See N70-31066 16-32)

7. APPENDIXES [ON MASS LOADING, RESONANCE, AND VIBRATION CHARACTERISTICS] 314 p (See N70-31067 16-32)

N70-31062*# North American Rockwell Corp., Downey, Calif. Space Div.
FREQUENCY AND MODAL ANALYSES BY SERIES-EXPANSION TECHNIQUE

In its Radial and Axial Transmissibility Characteristics of Typical Rocket Vehicle Struct. Dec. 1969 p 5-13 (See N70-31061 16-32)
Avail: CFSTI CSCL 20K

A set of linear equations are obtained for the interacted mode shapes and natural frequencies of cylindrical shells. Sine and cosine waves are used in describing the mass-load shell incorporating the change due to mass-loading effects. The shell structure is treated as a continuous system whose motions are described by a set of partial differential equations in Lagrange form. The series expansion method is emphasized and the fiqite element method is considered as an alternate method. J.M.C.

N70-31063*# North American Rockwell Corp., Downey, Calif. Space Div.
FREE-VIBRATION ANALYSES BY FINITE-ELEMENT APPROACH

In its Radial and Axial Transmissibility Characteristics of Typical Rocket Vehicle Struct. Dec. 1969 p 15-28 (See N70-31061 16-32)
Avail: CFSTI CSCL 20K

The Euler beam element was used to solve the mass-loaded shell problem by the finite element method. In the application of the finite element method, conventional engineering structures are visualized as an assemblage of structural elements interconnected at a discrete number of nodal pints. When the force-displacement relationships for the individual elements were known, it was possible, by using the direct stiffness method of structural analysis, to derive the properties and study the behavior of the assembled structure. J.M.C.

N70-31064*# North American Rockwell Corp., Downey, Calif. Space Div.
SHOCK AND FORCED VIBRATION ANALYSES

In its Radial and Axial Transmissibility Characteristics of Typical Rocket Vehicle Struct. Dec. 1969 p 29-57 (See N70-31061 16-32)
Avail: CFSTI CSCL 20K

The dynamic response of mass-loaded and unloaded shells is discussed. Particular emphasis is placed on the radial response of shells to radial vibration, longitudinal oscillation, and axial transient excitations. The problem of vibration response of unloaded, closed, cylindrical shells to such excitations is solved by the series expansion methods. Author

N70-31065*# North American Rockwell Corp., Downey, Calif. Space Div.
EXPERIMENTAL INVESTIGATION
In its Radial and Axial Transmissibility Characteristics of Typical Rocket Vehicle Struct. Dec. 1969 p 59-80 (See N70-31061 16-32)
Avail: CFSTI CSCL 20K

Three sets of radial vibration tests using the electro-induction shaker method were performed for the mass-loaded and unloaded shell models. A description of test methods and operations are outlined. Test equipment is also described. J.M.C.

N70-31066*# North American Rockwell Corp., Downey, Calif. Space Div.
COMPARISON AND CORRELATION OF EXPERIMENTAL RESULTS
In its Radial and Axial Transmissibility Characteristics of Typical Rocket Vehicle Struct. Dec. 1969 p 81-98 refs (See N70-31061 16-32)
Avail: CFSTI CSCL 20K

An empirical evaluation and comparison was made of the following four types of test data: modal characteristics of mass-loaded and unloaded shells and the variation of mode shapes and effective forcing area due to the incremental addition of mass-loads, radial response and effective forcing area associated with each of the first modes excited by radial force input, mass-loading effects on radial response and attenuation characteristics for mass ratios less than 0.1, and correlation of longitudinally excited shock responses to mass-loading effects or vibration of mass-loaded shells under radial excitations. Author

N70-31067*# North American Rockwell Corp., Downey, Calif. Space Div.
APPENDIXES [ON MASS LOADING, RESONANCE, AND VIBRATION CHARACTERISTICS]
In its Radial and Axial Transmissibility Characteristics of Typical Rocket Vehicle Struct. Dec. 1969 314 p (See N70-31061 16-32)
Avail: CFSTI CSCL 20K

Appended data of experimental results obtained from mass-loading and unloading shell vibration, shell imperfections, and theoretical solutions by series expansion. J.M.C.

N70-31218# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRESS, STABILITY, AND VIBRATION OF COMPLEX SHELLS OF REVOLUTION: ANALYSIS AND USER'S MANUAL FOR BOSOR3 Final Report, Jun. 1968 - Sep. 1969
David Bushnell 6 Sep. 1969 220 p refs
(Contracts F04694-68-C-0299; N00014-67-C-0256)
(AD-704204; LMSC-N-51-69-1; SAMSO-TR-69-365) Avail: CFSTI CSCL 13/13

A comprehensive computer program BOSOR3 for the stress, stability, and vibration analyses of segmented, ring-stiffened shells of revolution is presented. The program includes nonlinear prestress effects and is very general with respect to geometry of meridian, shell wall design, edge conditions, and loading. Despite its generality the program is easy to use. Branches are provided such that for commonly occurring cases the input data involve only basic information such as geometrical and material properties. The computer program has been verified by comparisons with other known solutions. This manual consists of several sections in which the program scope is described, the analysis on which it is based is given, the flow of calculations is outlined, the input data are defined with sample cases, various possible pitfalls are emphasized, and sample list and plot output is given and described. Author (TAB)

N70-31224# California Univ., Berkeley. Structural Engineering Lab.
ELASTIC DYNAMIC RESPONSE OF AXISYMMETRIC STRUCTURES
Edward L. Wilson Jan. 1969 62 p refs
(Contract DACA39-67-C-0020)
(AD-702989; SEL-69-2) Avail: CFSTI CSCL 13/13

The finite element method coupled with a stable step-by-step integration procedure was used for the elastic dynamic analysis of two-dimensional plane strain solids. The computer program developed was machine independent and was designed to be used in the dynamic analysis of day-to-day engineering problems. The purpose of this investigation is to extend the step-by-step approach to the analysis of axisymmetric structures. In addition, new coding techniques have been introduced in order to increase the capacity of the program. Also, a higher order axisymmetric finite element has been developed which has significantly increased the accuracy of the procedure for the same numerical effort. Since the axisymmetric formulation reduces the plane strain case for a large radius, the present axisymmetric computer program replaces the original program. Author (TAB)

N70-31282# General Electric Co., Schenectady, N.Y. Research and Development Center.
STRUCTURAL ANALYSIS BY INTEGRAL TECHNIQUE: PLANE ELASTICITY PROBLEMS
H. K. Liu and A. J. Martenson Oct. 1969 41 p refs
(Rept-69-C-366) Avail: CFSTI

A numerical method for the solution of plane elasticity problems which avoids the necessity of using an internal mesh system is described. Because of this, the technique uses less computer time and does not require the time consuming input preparation needed by the current mesh techniques. The method is employed to handle plane elasticity problems of arbitrarily shaped configurations with prescribed tractions. The procedures for analyzing two-dimensional homogeneous elastic, isotropic continua, as described here have been implemented in a digital computer program in FORTRAN 4 language. The results of several problems which have been solved to demonstrate the feasibility of the techniques are compared with those by other methods with almost perfect agreement. The basic techniques can be realistically extended to handle the general or axially asymmetric three-dimensional elasticity problems with or without thermal gradient effects. It can also be applied to the propagation of waves in elastic solid media. A companion report containing the program listing with instructions for the user is also available. Author

N70-31327# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF THE POSITION OF AN ELLIPTICAL HOLE ON STRESS CONCENTRATION IN A STRETCHED ORTHOTROPIC PLATE
S. G. Lekhnitskii et al 23 Jan. 1970 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 1, 1961 p 3-8
(AD-704056; FTD-HT-23-653-69) Avail: CFSTI CSCL 13/13

The problem considered is the stress around the boundary of an elliptical hole in an orthotropic plate. The plate possesses two perpendicular principal elasticity directions in its plane; one of these directions makes an angle with the major axis of the elliptical hole, and an angle with the direction of the applied tension. Author (TAB)

N70-31407# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF AIRCRAFT CONSTRUCTION

ELEMENTS. SANDWICH PANELS AND SHELLS (SELECTED ARTICLES)

L. E. Bryukker et al. 20 Jan. 1970 41 p refs Transl. into ENGLISH from the Russian

(AD-704058; FTD-MT-24-315-69) Avail: CFSTI CSCL 13/13

Contents: Simplified formulas for calculating sandwich plates with filters; Calculating the stability of sandwich plates beyond the proportionality limit. TAB

N70-31423*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.

ON SMALL VIBRATIONS AND PERTURBATIONS OF FLEXIBLE BODIES UNDERGOING ARBITRARY NOMINAL MOTION

Senol Utku 15 Jun. 1970 25 p refs

(Contract NAS7-100)

(NASA-CR-110435; JPL-TR-32-1477) Avail: CFSTI CSCL 20K

The increase in the pointing accuracy requirements of space vehicles has made it mandatory to take into account the structural flexibilities in the transfer function relating control torques to attitude angles. A finite element formulation of the governing equations of the perturbations and small vibrations of flexible structures undergoing arbitrary translations or rotational motion, or both is provided. The structure may or may not contain dampers, or rotating parts on flexible or rigid mounts. Having obtained the linearized governing equations, an approximate but practical method is described for obtaining the transfer function relating control torques to attitude angles. Author

N70-31444# Bettis Atomic Power Lab., Pittsburgh, Pa.

GAPL-1: A COMPUTER PROGRAM FOR THE PLASTIC STRESS ANALYSIS OF A HORIZONTAL PLATE WITH PRESSURE LOADING ABOVE AND DEFLECTION RESTRAINTS BELOW

C. M. Friedrich, W. H. Guilinger, and A. E. Sumner, Jr. Jan. 1970 51 p

(Contract AT(11-1)-GEN-14)

(WAPD-TM-731) Avail: CFSTI

GAPL-1 is a computer program performing the plastic stress analysis of a horizontal plate built-in at each end. Pressure loading is applied above and deflection restraints are placed below. The plate deflections are assumed uniform in the third direction. Author

N70-31471# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

ANALYSIS OF SINGLY SYMMETRIC OVAL RINGS WITH VARIABLE CROSS SECTION

Joseph E. Flaherty and William P. Vafakos Feb. 1970 44 p refs

(Contract Nonr-839(39))

(AD-703624; PIBAL-70-5) Avail: CFSTI CSCL 13/10

An analysis of singly-symmetric oval rings with variable cross-sectional properties, subjected to arbitrary radial and shear loads, is presented. The flange stresses in nonuniform reinforcing rings of ring-stiffened oval cylinders are obtained by assuming that such cylinders behave as composite rings. The stresses are shown to be in good agreement with available theoretical and experimental results. Author (TAB)

N70-31512# Battelle-Northwest Richland, Wash. Pacific Northwest Lab.

CYLINDRICAL ARRANGEMENTS OF UNIFORM SPHERES

R. Y. Dean and R. L. Richardson [1970] 45 p refs

(Contract AT(45-1)-1830)

(BNWL-CC-519) Avail: CFSTI

The systematic arrangement of uniform spheres is considered such that the envelope of the set of uniform spheres is an infinite cylinder. The particular arrangements which fill the cylinder to maximum density are specified in terms of the ratio of cylinder diameter to sphere diameter and were evaluated for values of the ratio between one and two. Additional arrangements possessing the greatest density were determined for values of the ratio from two to the quantity (1 + 2/square root of 3). The results indicate a method of covering cylinders with systematic arrangements of uniform spheres similar to the covering of a plane with equal circles, yielding the greatest density of uniform spheres in cylindrical shells. Author

N70-31548# Lockheed Missiles and Space Co., Palo Alto, Calif.

FORMULAS AND METHODS USED IN THE ANALYSIS OF PRESSURE VESSELS

Murat Kural 1970 62 p refs

(AD-703834; LMSC-4-11-66-5) Avail: CFSTI CSCL 13/4

The purpose of this report is to make available a compact summary of the formulas and methods used in the stress analysis of thin pressure vessels. The first part deals only with membrane forces and deformations resulting from pressure loading in shells of revolution. The formulas associated with axisymmetric edge loadings arising from discontinuities in the structure have been treated in the second part. The last part of the report is concerned with methods to predict unknown edge (discontinuity) forces and moments at junctures of shells. The entire formulation is restricted to pressure vessels where shell components fall into the category of thin, steep, and constant thickness shells of revolution. Furthermore, no coupling of edge effects is allowed. Author (TAB)

N70-31549# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

PROCEEDINGS OF THE SECOND CONFERENCE ON MATRIX STUDIES IN STRUCTURAL MECHANICS

L. Berke, R. M. Bader, W. J. Mykytow, J. S. Przemieniecki, and M. H. Shirk, eds. Dec. 1969 1154 p refs Conf. held at Wright-Patterson AFB, Ohio, 15-17 Oct. 1968

(AD-703685; AFFDL-TR-68-150) Avail: CFSTI HC (Individually Priced)/MF $0.65

The purpose of the conference was to discuss the recent developments in the field of matrix methods of structural analysis and design of aerospace vehicles. The forty papers presented were arranged into seven sessions: Structural Weight Optimization, Dynamics, General Elements, Curved Elements, Applications, General Methods, Nonlinear Analysis. Author (TAB)

N70-31568# Notre Dame Univ., Ind. Coll. of Engineering.

ON THE STRESSES AROUND AN ELLIPTIC HOLE IN A CYLINDRICAL SHELL

Bapu M. N. Rao and Teoman Ariman Feb. 1970 52 p refs

(Contract N00014-68-A-0152; Proj. Themis)

(AD-704180; THEMIS-UND-70-515) Avail: CFSTI CSCL 13/13

A theoretical analysis is presented for the membrane and bending stresses around an elliptic hole in an infinitely long, thin circular cylindrical shell. The shell is loaded by a uniformly distributed bending moment around the elliptic cutout. The method of solution involves perturbation in a curvature parameter and the results obtained are valid, if the hole is small in size compared to the shell. Author (TAB)

N70-31630# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

INVESTIGATION OF PLATES AND SHELLS UNDER EXTERNAL LOADING AND ELEVATED TEMPERATURES

Joseph Kempner Mar. 1970 23 p refs

(Contract F44620-69-C-0072)

(AD-703686; PIBAL-70-10; AFOSR-70-0834TR) Avail: CFSTI CSCL 13/13

The studies briefly described in this report stem from continuing investigations of plates and shells under external loading and

elevated temperatures, and include problems of special interest to designers of missiles and aircraft. Chapter 1 discusses the analysis of the buckling and postbuckling of noncircular (oval) cylindrical shells and related experimental investigations, the effects of boundary conditions, and the application of exact finite deformation theory of three-dimensional elasticity to the stability problem of thick-walled cylinders. Chapter 2 describes investigations of stress concentration problems for spherical shells. Chapter 3 discusses investigations of the effects of creep in plate and shell structures. Chapter 4 refers to recent work on wave propagation in layered shells. Author (TAB)

N70-31693# Naval Research Lab., Washington, D.C.
STRESS INTENSITY AND CRACK-OPENING DISPLACEMENT FOR COPLANAR CRACKS IN THERMOELASTICITY Interim Report
Whai-Sang Fu 25 Feb. 1970 20 p refs
(AD-704071; NRL-6987) Avail: CFSTI CSCL 20/11

The solution to the problem of two coplanar penny-shaped cracks in an infinite elastic medium is sought for the case where asymmetric heat flux or temperature difference is prescribed over the surfaces of the cracks. The problem is reduced to determining the solution to two sets of coupled Fredholm integral equations. An example is worked for a case where the temperature is prescribed over the crack faces and the heat flux normal to the plane containing the cracks is zero. The integral equations are then solved iteratively assuming that the spacing between the cracks is large relative to their radii. Physical quantities of interest, such as crack-opening displacement and stress intensity factor, are investigated. Author (TAB)

N70-31740# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF ANISOTROPIC THICK PLATES
S. G. Lekhnitskii 21 Jan. 1970 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Mekhan. i Mashinostr. (Moscow), no. 2, 1959 p 142–145
(AD-704036; FTD-HT-23-600-69) Avail: CFSTI CSCL 13/13

The material of the plate is assumed to be transversely isotropic, with the planes of isotropy parallel to the middle surface, and the material therefore possesses five independent elastic constants. Equations are given without detailed derivation for the displacements and stresses corresponding to a state of plane stress, and for the displacements, stresses and moments in a bent plate, both for the general case, and for the particular case of a plate bent by a uniformly distributed pressure in addition it its own weight. For a simply supported circular plate subjected to a uniformly distributed pressure the equations for displacements, stresses and moments are given, neglecting the weight of the plate. For the particular cases considered, the errors of the thin plate approximation are negligible if the material is isotropic, but are appreciable if the material is isotropic, but are appreciable if the material is anisotropic, the errors becoming larger the smaller the ratio. TAB

N70-31755# Technische Hochschule Munchen (West Germany). Fakultaet fuer Bauwesen.
THE EFFECT OF A NONLINEAR SEGMENT IN TWIST RESISTANCE ON THE EQUILIBRIUM AND STABILITY BEHAVIOR OF THIN WALLED STRAIGHT RODS [DER EINFLUSS EINES NICHTLINEAREN ANTEILS DES DREHWIDERSTANDES AUF DAS GLEICHGEWICHTS UND STABILITAETSVERHALTEN VON GERADEN DUENNWANDIGEN STAEBEN
Heinrich Kreuzinger (Ph.D. Thesis) 18 Dec. 1969 100 p refs In GERMAN
Avail: CFSTI

Considered is the torsion resistance caused by slanted longitudinal tension in thin walled cross sections and its effect on the equilibrium and stability behavior of straight rods. Torsional resistance was calculated by using the corresponding variable problem so that the linear differential equations contained nonlinear segments. Example calculations with approximation methods show that torsion decreased as the turning of the rod progressed and reached about 5% when the allowable shearing stress was obtained. Critical deformation loads during drill bending and tilting did not result in indefinite deformations which were caused only by load increases above the critical point. Transl. by G.G.

N70-31759# Technische Hochschule Munchen (West Germany). Fakultaet fuer Bauwesen.
APPLICATION OF THE FUNCTION THEORY FOR COMPUTING PLATES WITH SUDDENLY CHANGING BOUNDARY CONDITIONS [ANWENDUNG DER FUNKTIONENTHEORIE ZUR BERECHNUNG VON PLATTEN MIT SPRUNGHAFT VERAENDERLICHEN RANDBEDINGUNGEN]
Karl Schikora (Ph.D. Thesis) 18 Sep. 1969 108 p refs In GERMAN
Avail: CFSTI

Developed are two approximation methods for computing plates with suddenly changing boundaries; one provides a solution for polygonal plates and the other for rectangular shapes. The first method uses superimpositions of solutions for half plates with suddenly changing boundaries to find the desired boundary values, and the other used corrective solutions that do not effect already adjusted boundaries. Transl. by G.G.

N70-31778# Air Force Systems Command, Wright-Patterson AFB, Ohio.
APPLICATION OF LEGENDRE TRANSFORMS TO AN INVESTIGATION OF PLANE ELASTOPLASTIC WAVES OF A LOAD
V. Ya. Turchenko 5 Nov. 1969 17 p refs Transl. into ENGLISH from Samoletostroyeniye i Tekhn. Vozdushnogo Flota (USSR), No. 13, 1968 p 70–76
(AD-702849; FTD-MT-24-280-69) Avail: CFSTI CSCL 20/11

The author examines the one-dimensional unsteady motion of a continuous deformable medium whose dynamic properties under loading are characterized by a single relationship between stress and strain for all particles. The approximating curves can obtain points of inflection. The specific problem of longitudinal impact loading of a rod of finite length is solved, and the appearance of a shock front in the area of the first interaction of the load waves is studied. TAB

N70-31813*# Boeing Co., Huntsville, Ala.
ADVANCEMENTS IN STRUCTURAL DYNAMIC TECHNOLOGY RESULTING FROM SATURN 5 PROGRAMS, VOLUME 2
P. J. Grimes, L. D. Mc Tigue, G. F. Riley, and D. I. Tilden Jun. 1970 161 p refs
(Contract NAS1-8531)
(NASA-CR-1540; D5-17015) Avail: CFSTI CSCL 22B

Saturn V structural dynamic experience in replica modeling, math modeling and dynamic testing was assessed. Major problems encountered in each of these areas and their solutions are discussed. Volume II contains the methods and procedures used in the Apollo Saturn V structural dynamics programs. The major problems encountered and their solutions are discussed. Volume II is oriented toward the technical leaders of future structural dynamics programs. Author

N70-31819# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
EXPERIMENTS WITH A SUPERSONIC TUBE WIND-TUNNEL Final Report, Oct. 1968 – Nov. 1969
Joseph A. Johnson, III and Dominic Cagliostro Mar. 1970 51 p

refs
(Contract AF 40(600)-1133)
(AD-702806; AEDC-TR-70-71) Avail: CFSTI CSCL 14/2

An experimental study was performed of the unsteady processes in the starting period of a supersonic Ludwieg tube, a device which operates like an intermittent supersonic wind tunnel. A quick opening diaphragm located downstream of the nozzle initiates the flow. Pressure and density measurements are made in a variety of ways in Mach number 1.67 and 3.0 nozzles. For the starting conditions treated, supersonic flow is established in the nozzle without producing shock waves. Various time dependent functions are observed in the adjustment of gas-dynamic parameters to their steady supersonic values. These changes of pressure, et., include undershoots, overshoots, and other variations of the final steady-state values. Calculations based on an assumed zero-length nozzle do not adequately predict starting times and pressures.
Author (TAB)

N70-31851# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEVELOPMENT OF INVESTIGATIONS IN THE AREAS OF THERMOELASTICITY, THERMOPLASTICITY AND THERMOVISCOELASTICITY
A. D. Kovalenko [1970] 22 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 5, no. 12, 1969 p 1-16 Presented to the Jubilee Sci. Session of the Mech. Inst. of the Ukrain. Acad. of Sci., 1 Apr. 1969
Avail: Natl. Translations Center, John Crerar Library, Chicago, Ill. 60616

A brief survey of researches on thermoelasticity and thermoplasticity performed in the Ukraine is presented, where the following are included in the area of thermoelasticity: quasistatic problems of the thermoelasticity of plates and shells, quasistatic three dimensional problems of thermoelasticity, and dynamic and related problems of thermoelasticity. The development of an engineering elasticity theory and engineering dynamics for the study of the stress state, the stiffness and dynamics of structural elements of turbines are discussed. The development of theoretical and experimental investigations in the areas of thermoelasticity, thermoplasticity, and thermoviscoelasticity in connection with the analysis of the operation of new engineering structures is presented.
Author

N70-31924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLANE STRESSED STATE AND BENDING OF NONHOMOGENEOUS TRANSVERSALLY ISOTROPIC PLATE
S. G. Lekhnitskii 6 Feb. 1970 17 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Mekhan. Mashinostr. (USSR), no. 1, 1963 p 61-67
(AD-704203; FTD-MT-24-425-69) Avail: CFSTI CSCL 13/13

Generalization of the theory of elastic equilibrium of a thick plate (1, 2) is given for nonhomogeneous transversally isotropic plates of two types: (a) multilayer and (b) having elastic moduli, continuously changing in thickness. There are considered plates, being in plane stressed state and bent by loads distributed along the edges arbitrarily, and also uniformly along one of the plane surfaces. The constructed theories of plane stressed state and bending do not use hypothesis of straight normals and others (besides those usually taken in the linear theory of elasticity) and permit determining stresses and displacements, strictly satisfying all equations of the theory of elasticity, conditions on plane surfaces and on contact surfaces of layers. On lateral surface (on the edge) generally there are satisfied averaged or integral conditions, as in the theory of thin plates.
Author (TAB)

N70-31982 Catholic Univ. of America, Washington, D.C.
AXISYMMETRIC MODES OF VIBRATION OF A SOLID ELASTIC CYLINDER OF ARBITRARY LENGTH IDEALLY BONDED TO AN INFINITE RIGID CIRCULAR CYLINDRICAL TANK
Alfred Paul Mulzet (Ph.D. Thesis) 1968 61 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-8875

The natural frequencies of a solid elastic circular cylinder ideally bonded to an infinite, rigid, circular, cylindrical tank are determined for a large range of length to diameter ratios from the solution of the field equations for axisymmetric deformations of compressible elastic continua. The displacements are written as an infinite sum of the products of appropriate trigonometric and Bessel functions. The boundary conditions are written in terms of these displacements, and the resulting equations are expanded in Fourier trigonometric and Fourier Bessel series. The frequency equation is generated by requiring that the determinant of the coefficients of these series be zero. The frequency determinant is solved for all length to diameter ratios of the cylinder ranging from that corresponding to a thin plate to that corresponding to an infinite length cylinder. The resulting spectrum is plotted and is shown to degenerate for the extreme length to diameter ratios to those frequency spectrums predicted by the classical plate theory.
Dissert. Abstr.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-30602*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
HIGH-PERFORMANCE THERMAL PROTECTION SYSTEMS, VOLUME 2 Final Report
31 Dec. 1969 117 p refs
(Contract NAS8-20758)
(NASA-CR-102624; LMSC-A964947-Vol-2) Avail: CFSTI CSCL 20M

CONTENTS:

1. BIBLIOGRAPHY OF LITERATURE SURVEY MATERIALS. APPENDIX A 6 p refs

2. THERMAL PROTECTION SYSTEM ENVIRONMENTS FOR THE MODULAR NUCLEAR VEHICLE. APPENDIX B 10 p refs (See N70-30603 16-31)

3. DERIVATION OF ONE-DIMENSIONAL HEAT TRANSFER RELATION IN MULTILAYER COMPOSITES. APPENDIX C 20 p refs (See N70-30604 16-33)

4. FLAT PLATE CALORIMETER APPARATUS. APPENDIX D 11 p (See N70-30605 16-33)

5. CALORIMETRIC EMITTANCE AND REFLECTANCE MEASURING EQUIPMENT. APPENDIX E 14 p (See N70-30606 16-33)

6. PROPOSED SPECIFICATION FOR REFLECTIVE-SHIELD EMITTANCE. APPENDIX F 4 p (See N70-30607 16-33)

7. COMPUTER CODES USED IN STRESS AND THERMAL ANALYSIS OF SUPPORT STRUCTURE AND INSULATION. APPENDIX G 4 p refs (See N70-30608 16-33)

8. GAS FLOW APPARATUS. APPENDIX H 6 p (See N70-30609 16-12)

9. TASK 5 OUTGASSING APPARATUS AND GAS ANALYSIS DATA. APPENDIX I 22 p (See N70-30610 16-14)

10. A METHOD FOR ESTIMATING "AS-INSTALLED" THERMAL CONDUCTIVITY VALUES. APPENDIX J 5 p refs (See N70-30611 16-33)

11. SAMPLE EFFECTIVE WEIGHT PENALTY CALCULATIONS. APPENDIX K 9 p (See N70-30612 16-33)

N70-30604*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
DERIVATION OF ONE-DIMENSIONAL HEAT TRANSFER RELATION IN MULTILAYER COMPOSITES, APPENDIX C
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 20 p refs (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

The derivation of the engineering relation used to determine one-dimensional heat transfer via conduction and radiation through multilayer insulation composites is described. The relation was applied to extend measured effective thermal conductivity data obtained at 540/140 R insulation boundary temperatures for each composite tested to temperatures of 400/40 R, 350/40 R, and 220/40 R for a range of layer densities. The results were then applied in the effective weight parameter and in the sensitivity to the compression parameter used for comparing relative performance of candidate composites. Author

N70-30605*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
FLAT PLATE CALORIMETER APPARATUS, APPENDIX D
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 11 p (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

A description of the flat plate calorimeter (FPC) used for measuring effective thermal conductivity as a function of insulation laper density is presented. The major elements of the FPC are calorimeter and guard cryogen reservoirs, a hot-boundary heater plate, a vacuum chamber and pumping system, and means for remotely changing and measuring specimen thickness. A schematic of the FPC is shown. Author

N70-30606*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
CALORIMETRIC EMITTANCE AND REFLECTANCE MEASURING EQUIPMENT, APPENDIX E
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 14 p (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

The equipment and procedures used to measure the shield emittance and reflectance data are described. The apparatus shown consists of a copper supporting structure for the sample and black body receiver and a vacuum-tight stainless steel shell that surrounds the supporting structure. Vacuum access to the shell is provided through a 1-in. stainless steel tube welded in place. Author

N70-30607*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
PROPOSED SPECIFICATION FOR REFLECTIVE-SHIELD EMITTANCE, APPENDIX F
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 4 p (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

Methods are presented which can be used to evaluate the emittance of vacuum-metallized plastic-film materials that are used as the reflective shields of multilayer insulation. Material of a certain emittance is specified and the proposed methods are employed to ensure compliance with the specification. The supplier uses the same measurement techniques for quality control. Author

N70-30608*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
COMPUTER CODES USED IN STRESS AND THERMAL ANALYSIS OF SUPPORT STRUCTURE AND INSULATION, APPENDIX G
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 4 p refs (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

In providing the best possible stress and thermal analysis of the support structure and insulation, several digital computer codes were used. A brief summary is given for each code employed in the stress analysis of the conical and strut supports and in computing heat transfer through the tank supports and surrounding insulation. Author

N70-30611*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
A METHOD FOR ESTIMATING AS-INSTALLED THERMAL CONDUCTIVITY VALUES, APPENDIX J
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 5 p refs (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

A comparison of large scale tank test results and cryostat results using the same insulation composite shows the heat flux increases on the order of 1.5 to 8.8 times. This increase is due to a number of factors such as insulation system design, fabrication technique, tank size and shape, compression due to button installations, number of layers, folding of flat materials over compound curvatures, variations in installed layer density, degradation due to parallel condition in the multilayers around penetrations, and radiation tunneling through joints. It is assumed that compression of the multilayers causes the increased heat flux values for tank installations. Author

N70-30612*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Propulsion Vehicle Systems.
SAMPLE EFFECTIVE WEIGHT PENALTY CALCULATIONS, APPENDIX K
In its High-Performance Thermal Protect. Systems, Vol. 2 31 Dec. 1969 9 p (See N70-30602 16-33)
Avail: CFSTI CSCL 20M

To illustrate how the effective weight penalty equations given earlier were used to calculate performance data, sample calculations are provided for the C-D-A-M/Tissuglas insulation composite. In these calculations, the true optimum case was selected by determining the time when boiloff was initiated and comparing this time with the assumptions used in deriving the equations. The true optimum case can also be determined by calculating effective weight penalties for each case and selecting the minimum value. Author

N70-30613# IIT Research Inst., Chicago, Ill.
MAGNETIC FIELD EFFECTS ON THE THERMAL CONDUCTIVITY OF Co[(NH2)2CS]4.Cl2
Chen-Chou Ni (Ph.D. Thesis) Jan. 1970 123 p refs Sponsored by AEC
(COO-1629-16) Avail: CFSTI

By means of low temperature thermal conductivity measurements, the following distinctive phenomena were observed and interpreted according to existing theories: (1) The phenomenon of antiferromagnetic spin wave thermal energy transport was observed below the Neel temperature and its physical behavior is in qualitative agreement with the uniaxial two sublattice model for which the spin wave propagation is polarized in the spontaneous magnetization direction. (2) The temperature and applied magnetic field dependence of thermal conductivity above the Neel temperature shows that the ground state of the magnetic ion Co(++) is a Kramers doublet. This conclusion is in agreement with specific heat measurements. (3) Anomalies expected according to the theoretical predictions for spin wave energy density fluctuations in the region of a magnetic phase transition were observed. Magnetic phase transition boundaries were mapped out from the thermal conductivity measurements by judicious variation of both temperature and applied magnetic field. Author

N70-30681# Joint Publications Research Service, Washington, D.C.
RADIANT HEATING
B. A. Grigoryev 17 Apr. 1970 24 p refs Transl. into ENGLISH from Russian journals
(JPRS-50348) Avail: CFSTI

CONTENTS:
1. SOME PROBLEMS OF RADIANT HEATING OF AN INFINITE PLATE B. A. Grigor'yev p 1–8 refs (See N70-30682 16-33)
2. CERTAIN PROBLEMS OF HEATING OF AN INFINITE PLATE BY NONSTEADY-STATE RADIANT FLUXES B. A. Grigor'yev p 9–21 refs (See N70-30683 16-33)

N70-30682# Joint Publications Research Service, Washington, D.C.
SOME PROBLEMS OF RADIANT HEATING OF AN INFINITE PLATE
In its Radiant Heating 17 Apr. 1970 p 1–8 refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Belorussia), v. 1, no. 9, 1958 p 29–35 (See N70-30681 15-33)
Avail: CFSTI

A solution is offered to the problem of the radiant heating of an infinite plate for a case when in the first of the two intervals into which the radiation is separated at all times, the dependences of the irradiance on time are similar and are described by the product of the power and exponential functions of time, while in the second interval, the similarity of the relationships is disrupted and they are described by simple exponents. Author

N70-30683# Joint Publications Research Service, Washington, D.C.
CERTAIN PROBLEMS OF HEATING OF AN INFINITE PLATE BY NONSTEADY-STATE RADIANT FLUXES
In its Radiant Heating 17 Apr. 1970 p 9–21 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk (Moscow), v. 1, no. 1, 1958 p 86–94 (See N70-30681 15-33)
Avail: CFSTI

The nonstationary characteristics of radiant pulse type fluxes are examined in terms of power and exponential functions of irradiation time. The discussion is limited to products which describe the relationship of the exposed surface to the power and exponential functions of time. Dimensionless values are adopted for the transformations. J.M.C.

N70-31046# Frankford Arsenal, Philadelphia, Pa.
DEVELOPMENT AND QUALIFICATION OF INITIATOR, XM100 Technical Report, Feb. 1967 – Sep 1968
George P. Catrambone Sep. 1969 52 p refs
(AD-700758; FA-R-1938; ASD-TR-69-103) Avail: CFSTI CSCL 19/1

This report describes the development and qualification of the XM100 Initiator. The XM273 Impulse Cartridge is contained in the initiator and, when fired, provides a pressure output of approximately 1500 psig at -65 degrees F with 15 feet of Teflon no. 4 size hose. The maximum pressure obtained when fired with one-half foot of hose at 200 degrees F is approximately 6000 psig. The initiator incorporates a simplified firing mechanism that is mechanically actuated. In addition to the normal bulkhead mounting, the initiator has a universal bracket that offers greater flexibility for mounting than designs presently in use. Author (TAB)

N70-31244# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
THEORY OF EXPLOSIONS
John H. Lee, Romas Knystautas, and Glen G. Bach Nov. 1969 330 p refs
(Grants AF-AFOSR-1290-67; NRC A-3347; NRC A-118; NRC A-7091)
(AD-704157; MERL-69-10; AFOSR-69-3090TR) Avail: CFSTI CSCL 19/4

The report starts out by discussing the physics of explosions in terms of physical concepts and experimental observations. Close affinity between explosion and implosion phenomena and gaseous detonation combustion is shown. The bulk of the report then presents the ground work for the theoretical study of explosions outlining the governing equations, boundary conditions and solutions of specific problems. Author (TAB)

N70-31290 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF ARTIFICIAL ROUGHNESSES ON CRITICAL HEAT FLUX DENSITY UNDER FORCED CONVECTION
E. Burok et al 27 Apr. 1970 11 p refs Transl. into ENGLISH from Atomkernenergie (Munich), no. 5, 1969 p 305–308
(NLL-WH-Trans-291-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The critical heat flux density of subcooled water under forced convection was measured in annular channels with smooth and rough inner tubes. Various forms of roughness were investigated with the depth of roughness being between 2.6 microns and 0.3 mm. Author

N70-31291# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Centro Atomico Bariloche.
THE EFFECT OF NORMAL PROCESSES ON THE THERMAL CONDUCTIVITY IN A FINITE INSULATOR SAMPLE [EFECTO DE LOS PROCESOS NORMALES EN LA CONDUCTIVIDAD TERMICA DE MUESTRAS FINITAS DE AISLANTES]
Hugo Nazareno (Cordoba Natl. Univ.), Gabriela Carabelli, and Blas Alascio (Cordoba Natl. Univ.) 1969 12 p refs In SPANISH
(CNEA-230) Avail: CFSTI

A model is proposed for calculating the thermal conductivity of finite sections of insulation. Specific calculations are presented for two different geometries and in the limited cases, where the free flow by normal collisions is very great or very small, in proportion to the characteristic dimensions of the sample. Transl. by F.O.S.

N70-31338# RAND Corp., Santa Monica, Calif.
EXACT SOLUTION OF THE RADIATION HEAT TRANSPORT EQUATION IN A GAS-FILLED SPHERICAL CAVITY
E. C. Gritton and A. Leonard Feb. 1970 48 p refs
(Contract F44620-67-C-0045)
(AD-702791; RM-6175-PR) Avail: CFSTI CSCL 20/13

The report treats the case of steady-state, radiative heat transport through an absorbing, emitting, and heat-generating gray gas contained inside a black-wall spherical cavity. An exact analytical solution to the radiative transport equation is obtained for the case of uniform heat generation throughout the gaseous medium. The problem is formulated in terms of an integral equation with a difference kernel over a finite interval. A complex function is introduced for the source function. This in turn leads to a singular integral equation of the principal-value type that can be solved by standard techniques. An exact solution is found that yields the entire distribution of the gas emissive power. When this exact transport theory solution is compared with the Rosseland diffusion theory, the latter is shown to be capable of describing only the overall spatial dependence of the emissive power distribution. The solution has applications for high-temperature systems such as military rockets, reentry vehicles, gaseous-fueled cavity reactors, and modern power plants. Author (TAB)

N70-31374 National Lending Library for Science and Technology, Boston Spa (England).
THE IGNITION OF EXPLOSIVE MIXTURES BY STATIC ELECTRICITY [ZUENDUNG EXPLOSIBLER GEMISCHE DURCH STATISCHE ELEKTRIZITAET]
E. Heidelberg 3 Jan. 1970 21 p refs Transl. into ENGLISH from Proc. of the Intern. Conf. on the Safe Use of Elec. Energy in Spaces where the Danger of an Explosion Exists, (Gottwaldo), West Ger., Oct. 1968 Paper no. 8
(NLL-SMRE-Trans-5789-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.; 2 NLL photocopy coupons

The electrostatic discharge in explosive gaseous mixtures or vapors from combustible liquids is studied as the ignition phenomenon for the formation of self-propagating flames. The ignition energies of spark and corona discharges, and the effect of nonconducting layers on conductors are discussed. Grounding points for conductors, and grounding metal meshes for nonconductors are recommended as protective measures. F.O.S.

N70-31446# Sandia Corp., Albuquerque, N. Mex.
SURVEY OF THREE-DIMENSIONAL FINITE DIFFERENCE FORMS OF HEAT EQUATION
Jimmie H. Smith Mar. 1970 63 p refs Sponsored by AEC
(SC-M-70-83) Avail: CFSTI

Many computer simulations of heat transfer problems were carried out. Among the most important simulations are those involving atmospheric reentry. These reentry analyses using finite difference techniques consume one or more hours on high speed digital computers for each simulation. A successful search for a significantly faster technique is presented here. One of the fastest techniques which is widely used in industry is the Crank - Nicolson method. The Douglas-ADI is found to be an order of magnitude faster. The Douglas Technique was devised nearly a decade ago. But, as yet, it is only well known to those people who study numerical techniques per se. This technique has not been incorporated into the major heat transfer codes in industry. Author

N70-31456# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
SECOND SOUND IN SOLIDS
J. A. Krumhansl and R. O. Pohl [1970] 8 p refs
(Contract AT(30-1)-2391)
(NYO-2391-110) Avail: CFSTI

The subject of heat conduction in solids is one of the oldest and most fundamental in the study of condensed matter. Ever since the early days of modern physics the point of view taken usually concerned the macroscopic, steady state, heat energy transport. Only in recent years has a satisfactory understanding of the underlying processes been developed. We wish to report how the application of high speed pulsed heat techniques has now succeeded not only in elucidating the conventional forms of heat flow, but also has verified a new kind of heat flow in crystals—called "second sound." Author (NSA)

N70-31508# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRANSIENT HEATING OF THIN PLATES
Harold J. Breaux and Palmer R. Schlegel Feb. 1970 25 p refs
(AD-702890; BRL-R-1471) Avail: CFSTI CSCL 20/13

Two classes of heating problems involving the heating of thin plates over a portion of their surface are considered. Such problems have numerous applications, one such application being the determination of the temperature rise in materials upon which a laser beam is directed. The heating effects caused by a laser beam fits into the class of problems for which the heating source has circular symmetry. The second class of problems arises when the source term has symmetry about a line on the surface. Solutions in the form of a definite integral are obtained for both classes of problems for a general time independent source of unspecified spatial distribution. Several solutions in closed form are obtained for particular source functions and for particular values of the various parameters of the problem. For the case of a disk source an error bound useful in the numerical quadrature of the integral solution is obtained. Author (TAB)

N70-31519# Los Alamos Scientific Lab., N. Mex.
THE SPACE ELECTRIC POWER R AND D PROGRAM, PART 1 Quarterly Status Report, Period Ending 31 Jan. 1970
20 Feb. 1970 5 p refs
(Contract W-7405-eng-36)
(LA-4374) Avail: CFSTI

Results of investigations directed toward a better understanding of heat pipe operational principles are presented. Progress toward the design of a mercury space radiator having a heat-rejection capability that is temperature-dependent is reported. Tests are in progress on heat pipes with wicks consisting of layered woven wire screen. Results of calculations on heat transfer limitations imposed by sonic vapor flow, liquid entrainment, wicking ability, and boiling in the wick are presented for each wick. In other work, treatment of stainless steel pipes to prevent internal hydrogen buildup is reported. NSA

N70-31751# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE STRESSES FORMING IN CYLINDERS UNDER THE EFFECT OF A LUMINOUS FLUX
V. I. Danilovskaya et al 25 Feb. 1970 8 p refs Transl. into ENGLISH from Fiz. Khim. Obrabotki Materialov (USSR), no. 4, 1969 p 16-18
(AD-704020; FTD-HT-23-34-70) Avail: CFSTI CSCL 20/5

Analyzed are temperature fields and stresses produced in cylinders by a monochromatic isotropic radiant energy flux with the assumption that the material of the cylinder absorbs energy according to the Bouguer law. The results have been generalized for the case of a flux containing rays with a wave length changing in a given range. Author (TAB)

N70-31772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-TEMPERATURE RESEARCH (SELECTED CHAPTERS)
Ya. A. Kraftmakher 14 Jan. 1970 49 p refs Transl. into ENGLISH from the Russian
(AD-704032; FTD-HT-23-18-69) Avail: CFSTI CSCL 11/6

The author reviews the previous methods for measuring heat capacities of solids at high temperatures, concluding that each of these is inadequate for reasons of accuracy or ease of measurement. He then presents the theory, procedure and apparatus for the modulation method developed by his group at the Institute of Thermophysics, Siberian Division, Academy of Sciences of the USSR. The concluding two chapters present experimental data on heat capacity and vacancy formation in refractory metals, derived by the use of the new technique. Author (TAB)

N70-31787*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PRELIMINARY ANALYSIS TO DETERMINE THE REENTRY INSULATION REQUIREMENTS ON A PIONEER-TYPE HEAT SOURCE FOR USE IN THE ISOTOPE BRAYTON APPLICATION
Raymond K. Burns Jun. 1970 44 p refs
(NASA-TM-X-52850) Avail: CFSTI CSCL 20M

A systematic analytical approach to determine the thermal property requirements of the reentry protection on isotope heat sources is presented. Such an approach is necessary in order to

satisfy both reentry and steady state thermal requirements in present heat source designs in which heat is transferred through the reentry materials during power system operation. Results are presented for a Pioneer-type heat source which is being considered for the isotope Brayton application. The results indicate that the range of thermal properties of the heat source reentry materials which will result in acceptable temperatures during reentry and during steady state Brayton power system operation is very limited. Author

N70-31820# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THEORY OF HEAT TRANSFER DURING FRICTION OF METALS ON THERMOPLASTICS UNDER HEAVY LOADS

A. I. Leonov et al 20 Jan. 1970 22 p refs Transl. into ENGLISH from the Publ. "Nauchnyy Sovet po Treniyu i Smazkam. Voprosy Treniya i Problemy Smazki" Moscow, 1968 p 87-97 (AD-704198; FTD-MT-24-361-69) Avail: CFSTI CSCL 11/9

For the case of friction of two infinite steel-polymer plates the condition of formation of a melt as a result of the heat of friction was derived. The thermohydrodynamic problem about motion of the polymer melt over the metal was solved taking into account phase transition, non-Newtonian character of viscosity and dependence of viscosity on temperature. Distribution of temperatures and speeds in the liquid film of the melt were determined, and also the dependence of frictional force and thicknesses of film on speed. Thickness of film sharply increases, and frictional force drops, which is in qualitative agreement with experiment. Author (TAB)

N70-31839# California Univ., Livermore. Lawrence Radiation Lab.

LOW-PRESSURE PLANE WAVE LENS

Paul B. Archibald 10 Nov. 1969 11 p refs Sponsored by AEC (UCRL-50770) Avail: CFSTI

A low-pressure plane wave lens was constructed using a sheet explosive for the fast component and a low-density PETN composition for the slow component. The lens has a 4 in. diameter and a planarity of + or - 7 sh. The pressure of the emergent shock wave is 6.5 kbar as measured by a quartz crystal transducer. Transit time is 20.1 microsec. The total weight of the explosive is 39 g. Author

N70-31898 Drexel Inst. of Tech., Philadelphia, Pa.

FILM COOLING WITH INJECTION THROUGH MULTIPLE SLOTS

Andrew Mark (Ph.D. Thesis) 1969 189 p

Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-20139

Experimental data of air-to-air injection at multiple stations are obtained in a slow speed wind tunnel for a constant pressure field. The bottom plate of the test section serves as an adiabatic wall in which sixty thermocouples are embedded to measure the adiabatic wall temperature. This is subsequently presented in terms of a dimensionless temperature ratio called the effectiveness which is plotted against a dimensionless position downstream. The test plate also contains three nearly tangential injection slots spaced at six inch intervals. An analysis of film cooling with multiple slot injection was performed by using a control volume approach. An assumption of the one seventh power velocity profile and the flat temperature profile is employed in this approach. The effectiveness behind each slot is calculated. A comparison is made with the existing multiple slot analysis of Volchkov et al. It is found that the present analysis compares more favorably with experimental data. Dissert. Abstr.

N70-31918*# AiResearch Mfg. Co., Los Angeles, Calif.

HEAT TRANSFER AND FLUID FLOW ANALYSIS OF HYDROGEN-COOLED PANELS AND MANIFOLD SYSTEMS

F. M. Walters and O. A. Buchmann [1970] 175 p refs (Contract NAS1-5002)

(NASA-CR-66925) Avail: CFSTI CSCL 20M

This report describes an analytical study of the performance of flat, hydrogen-cooled heat exchanger panels, as part of a comprehensive investigation of problems associated with design and fabrication of efficient regeneratively cooled structural panels. Heat exchangers were designed and performance was calculated for several panel concepts in a range of loads from 10 to 500 Btu/sec-sq ft. Factors that influence heat exchanger and manifold system design, such as state of the art, materials, and fabrication techniques are set forth. Parametric data on the performance of a broad array of coolant passage geometries are presented. The potential for coolant conservation and reduction of temperature differentials by use of various methods of flow manifolding, flow folding, multiple stacking of heat exchangers, and insulation are discussed. Analytical and experimental studies of rectangular and triangular flat-manifold systems show the effects of geometry variation on pressure drop and panel flow distribution. Author

N70-31945*# Resalab Scientific, Menlo Park, Calif.

CHARACTERIZATION OF RTG PERFORMANCE IN BOTH AIR AND VACUUM

Dean Leonard, Scott Luebbers, and Valvo Raag 20 May 1970 85 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952808)

(NASA-CR-110504; Memo-7) Avail: CFSTI CSCL 20M

A preliminary investigation of the effects of air operation on silicon-germanium RTG performance was conducted. Initially the generator internal components are considered exposed to the air environment. After evaluating generator performance under these conditions, inert gases are introduced into a hermetically sealed generator and the generator performance is reexamined. The gases included are: argon, helium, krypton, and xenon. Because in some applications power is required from the RTG even during the launch phase, another and related purpose of the present study is to determine the amount of such power available from typical silicon-germanium RTG's in air operation and with various internal gases. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-30688# Army Engineer Topographic Labs., Fort Belvoir, Va.

NEW ANALYSES AND METHODS LEADING TO IMPROVED TARGET ACQUISITION REQUIREMENTS INVOLVING SYSTEMS, GEODETIC AND RE-ENTRY ERRORS, AND INCREASED WEAPONS EFFECTIVENESS FOR CONVENTIONAL WEAPONS, PART 1

Han Baussus-Von Luetzow Jan. 1970 22 p refs

(AD-702923; USAETL-RN-35) Avail: CFSTI CSCL 19/5

After a cursory critique of currently used methodology for the study of target accuracy requirements for artillery weapons, this research report is concerned with the development of analytical methods and two different though interrelatable and essentially additive optimization concepts. If implemented within the context of TACFIRE, these are conservatively estimated to provide on the average a 30% greater weapons effectiveness. Although the intra and extra weapons systems employment parameters are interdependent, variable, and changing, an integrated operational optimization is achieved. The methods outlined are also useful in weapons R and D and related systems analyses. Furthermore, the

rather cogent requirements and related recommendations or conclusions arrived at may be of considerable significance for certain R and D and combat development activities. Author (TAB)

N70-30675# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 228
13 May 1970 89 p Transl. into ENGLISH from Russian periodicals (JPRS-50505) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1-6 (See N70-30676 16-30)
2. METEOROLOGY p 7-22 (See N70-30677 16-20)
3. OCEANOGRAPHY p 23-31 (See N70-30678 16-13)
4. TERRESTRIAL GEOPHYSICS p 32-50 (See N70-30679 16-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 51-78 (See N70-30680 16-13)

N70-30998# Toronto Univ. (Ontario).
INSTITUTE FOR AEROSPACE STUDIES Annual Progress Report, 1969
Nov. 1969 331 p refs
(AD-700574) Avail: CFSTI CSCL 20/4

The research program at the Institute for Aerospace Studies is concentrated in three main areas: aeronautical, space technology and science, and flight transportation. There are at present 136 investigations proceeding with the support of 13 agencies. Highlights of these projects are described. Author (TAB)

N70-31105# National Bureau of Standards, Washington, D.C. Electricity Div.
INTERNATIONAL WEIGHTS AND MEASURES
Chester H. Page *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 1-3 Presented at 20th Ann. ISA Conf. and Exhibit, Los Angeles, 4-7 Oct. 1965 Submitted for publication Instr. Soc. of Am. Preprint No. 33.3-1-65 (See N70-31104 16-09)
Avail: SOD $4.50

A brief survey of the background, organization, and operation of the International Bureau of Weights and Measures and related committees is presented. Author

N70-31106# National Bureau of Standards, Washington, D.C.
ELECTRICAL UNITS
Forest K. Harris *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 4-7 Presented at 19th Ann. ISA Conf. and Exhibit, New York, 12-15 Oct. 1964 Submitted for publication Instr. Soc. of Am. Preprint No. 12.1-1-64 (See N70-31104 16-09)
Avail: SOD $4.50

The origin, development, and present status of the units of electrical measure are briefly reviewed. The distinction between the defined MKSA units and the legal units that form the basis of the practical measuring system in the United States is stated, and the differences between the two systems are examined. Author

N70-31107# National Bureau of Standards, Washington, D.C. Electricity Div.
DEFINITION OF "AMPERE" AND "MAGNETIC CONSTANT"
Chester H. Page *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 8 refs Reprinted (See N70-31104 16-09)
Avail: SOD $4.50

The measurement unit and the abstract unit of ampere are discussed, taking the measurement unit problem as basic. The magnetic constant is defined as the proportionality constant in the equation expressing the force between two current elements in space. It is arbitrarily assigned the value of 4 pi × 10 to the −7th power. The acceptance of the ampere as the fourth principal unit is mentioned, and the abstract mathematical or symbolic ampere is chosen as the undefinable, intuitive element of the electrical set. N.E.N.

N70-31108# National Bureau of Standards, Washington, D.C.
ELECTRICAL STANDARDS AND MEASUREMENTS
I. L. Cooter, B. L. Dunfee, F. K. Harris, W. P. Harris, F. L. Hermach et al *In its* Precision Meas. and Calibration, Vol. 3 Dec. 1968 p 9-28 refs Revised (See N70-31104 16-09)
Avail: SOD $4.50

The means by which the National Bureau of Standards has established the legal units of electrical measure are briefly reviewed. The experimental procedures by which the values of the basic reference standards are made available as initial links in all the measurement chains that form the National Measurement System are discussed. Author

N70-31255# California Univ., Berkeley. Lawrence Radiation Lab.
AN SDI SYSTEM BASED ON NSA MAGNETIC TAPES. USER PROFILING AND THE IMPLICATIONS OF DECENTRALIZED INDEXING
G. L. Smith, J. J. Herr, and R. K. Wakerling Dec. 1969 14 p refs Presented at a Symp. on Handling of Nucl. Inform., Vienna, 16-20 Feb. 1970
(Contract W-7405-eng-48)
(UCRL-19290; SM-128/33; CONF-700206-2) Avail: CFSTI

An information research project in selective dissemination of information (SDI) and decentralized indexing is discussed. SDI programs were developed and are in use with input tapes of Nuclear Science Abstracts to select and disseminate printed references of interest to laboratory scientists. Techniques were produced and tested for developing user profiles and for subsequently refining and updating them. Knowledge and experience gained in the process of indexing for the NSA tape system are being applied to SDI retrieval. NSA

N70-31351# Army Logistics Management Center, Fort Lee, Va.
THE NATION'S RESEARCH AND DEVELOPMENT EFFORT
Alan R. Loper 1969 29 p refs
(AD-704364; ALM-2416-H) Avail: CFSTI CSCL 5/1

A summary is provided of the research and development in the U. S. in terms of a brief history, some discussion of the federal organizations involved, some financial and manpower considerations, mention of the transfer of defense technology to the civilian sector, and a forecast of subjects for attention. Author (TAB)

N70-31424*# Maryland Univ., College Park. Computer Science Center.
AN ANALYSIS OF SOME GRAPH THEORETICAL CLUSTER TECHNIQUES
J. Gary Augustson and Jack Minker Jan. 1970 46 p refs
(Grant NGL-21-002-008; Contract NBS-CST-821-5-69)
(NASA-CR-110447; TR-70-106) Avail: CFSTI CSCL 05B

Graph theoretic cluster techniques aimed at the automatic generation of thesauri for information retrieval systems are explored. Experimental cluster analysis is performed on a sample corpus of 2267 documents. A term-term similarity matrix is constructed for the 3950 unique terms used to index the documents. Various threshold values, T, are applied to the similarity matrix to provide a series of binary threshold matrices. The corresponding graph of each binary threshold matrix is used to obtain the term clusters. Three definitions of a cluster are analyzed: (1) The connected components of the threshold matrix. (2) The maximal complete subgraphs of the connected components of the threshold matrix. (3)

PUBLIC COLLECTIONS OF NASA DOCUMENTS

A cluster of the maximal complete subgraphs of the threshold matrix. Algorithms are analyzed for obtaining each cluster type. Author

N70-31429# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Bad Godesberg (West Germany). Aeromedical Inst.

LEGAL RIGHTS OF NEIGHBORING PROPERTY OWNERS DURING CONSTRUCTION OF UNDERGROUND TRAFFIC SYSTEMS [RECHTSANSPRUECHE DER ANLIEGER BEIM BAU UNTERIRDISCHER VERKEHRSANLAGEN]

H. G. Heym *In its* 3rd Working Session on Decompression Diseases Sep. 1969 p 33-49 refs In GERMAN (See N70-31426 16-05)

Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 38,70 DM

The close relationship between traffic politics and construction technology with legal questions in regard to bordering properties is developed and an effort is made to unify the multitude of singular and special regulations into one common legal authority for transportation developments in all West German states. Considered are compensation awards based on the German neighbor law code that covers permissible noise and vibration levels, possible results of lowered ground water levels and underground tunnel construction, as well as damages to the earning capacity of individuals due to street closings or other inconveniences. Transl. by G.G.

N70-31447# Oak Ridge National Lab., Tenn. Chemical Technology Div.

A DYNAMIC PROGRAMMING SOLUTION OF THE ELECTRIC GENERATING SYSTEM UNIT COMMITMENT PROBLEM

David S. Joy Apr. 1970 46 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2881) Avail: CFSTI

The optimal scheduling of a series of power generating plants to satisfy a time varying system load is known as the unit commitment problem. A simplified unit commitment problem was formulated that considered the possible use of the six fossil plants to meet system load and spinning reserve requirements which were specified over 84 time periods. Dynamic programming proved to be a flexible and powerful tool for analyzing the unit commitment problem. By careful formulation, only a single state variable and a single control variable are required to describe the problem. The optimal distribution of the system load over the operating plants is determined using a set of quadratic functions to represent the operating cost vs plant load data for the individual plants. Two cases of the unit commitment problem were studied. In each case, the peak load, spinning reserve requirement, and plant startup priority order were specified. For each case, the optimal dispatching sequence which minimizes the total system costs was determined. The computational time required to find the optimal trajectory was approximately two seconds on an IBM 360/91 computer. Author

N70-31450# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIENCE IN DEVELOPING, INTRODUCING AND USING DESCRIPTOR INFORMATION RETRIEVAL SYSTEMS UNDER SCIENTIFIC RESEARCH CONDITIONS

Yu. I. Valov et al 7 Jan. 1969 21 p refs Transl. into ENGLISH from Nauch.-Tekh. Inform., Ser. 1 (USSR), no. 2, 1968 p 22-26

(AD-704051; FTD-MT-24-414-69) Avail: CFSTI CSCL 5/2

For the purpose of studying the peculiarities of creation and operation of descriptor systems in a local information unit, the Information Department of a research institute is developing a large descriptor IRS capable of answering a bulk of requests received at the institute's reference service. The system consists of subsystems, covering altogether 70,000 documents, and providing responses to 70 percent of requests. The system is implemented on peek-a-boo cards accomodating 1,600 holes each. The basic assumptions and decisions of policy are described. Creation of descriptor IRS in the specific conditions of a research institute is in the focus of attention as an organization of various information services in creating descriptor systems which is a very involved and effort - consuming task. Author (TAB)

N70-31459# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.

ON BROWSING: THE USE OF SEARCH THEORY IN THE SEARCH FOR INFORMATION

Philip M. Morse Feb. 1970 40 p refs

(Contract DA-31-124-ARO(D)-209)

(AD-702920; TR-50; AROD-968-58-M) Avail: CFSTI CSCL 5/2

Search theory, originally developed for antisubmarine search, is applied to the scanning of library shelves for books of interest, or of a computerized abstract catalogue for items of immediate application. Procedures for optimizing the information to be found are discussed, as well as methods whereby the operational parameters can be measured. The organization and reorganization of a library, or other informational system, so as to improve its response to a searcher, are treated and curves are provided which indicate the degree and nature of the reorganization which can optimize this improvement. Author (TAB)

N70-31615# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Porz (West Germany).

INDEX OF DVL REPORTS IN THE SERIES GERMAN AIR AND SPACE FLIGHT, 1 JANUARY 1969-31 MARCH 1969, SUPPLEMENT 4 [VERZEICHNIS DER DVL-BERICHTE IN DER REIHE DEUTSCHE LUFT- UND RAUMFAHRT, 1 JANUAR 1969-31 MAERZ 1969, ERGAENZUNG 4]

Jan. 1970 17 p In GERMAN

(DVL-900-Suppl-4) Avail: CFSTI

This index contains the titles of reports published during January, 1969 through March, 1969. Brief abstracts for almost all reports can be obtained in German as well as in English from the scientific secretary of the DVL. Transl. by G.G.

N70-31699# Technical Communications Corp., Los Angeles, Calif.

BASE ENGINEER AUTOMATED MANAGEMENT SYSTEM (BEAMS): TRAINING AT SHEPPARD TECHNICAL TRAINING CENTER Technical Report, Sep. 1967-Sep. 1969

J. Highcove, J. Kibbee, R. Stout, and L. F. Dominguez Dec. 1969 55 p refs

(Contract F33615-68-C-1076)

(AD-702866; AFHRL-TR-69-24) Avail: CFSTI CSCL 5/9

Instructional materials including plans of instruction, student workbooks, instructor guides, and simulated automated transactions were developed for use with hardware and software in courses of instruction designed to teach Air Force personnel to operate, maintain and utilize the base engineer automated management system (BEAMS). When supported by the necessary instructional materials for integrating them into organized instructional activities, simulations provide effective training systems. Author (TAB)

N70-31737# Air Force Systems Command, Wright-Patterson AFB, Ohio.

PRAVDA EDITORIAL ON ORGANIZATION OF SCIENCE IN THE USSR

6 Mar. 1970 8 p Transl. into ENGLISH from Pravda (Moscow), 24 Jan. 1970 p 1

(AD-704023; FTD-HT-23-165-70) Avail: CFSTI CSCL 5/11

The Soviet Pravda article generalizes about Socialism, Social Science, and various Scientific Research Institutes. The editorial advocates increased liaison between Research Institutes to become

more efficient and effective in solving problems of mutual interest. Important Soviet science centers are being founded in the Urals and Far East. Author (TAB)

N70-31745*# Syracuse Univ., N.Y.
PROJECT MANAGEMENT IN THE APOLLO PROGRAM INTERIM REPORT
E. E. Drucker, W. Pooler, D. L. Wilemon, and B. D. Wood Apr. 1970 35 p refs Presented at NASA, Washington, 29 Jun. 1970
(Grant NGL-33-022-090)
(NASA-CR-110497; IR-6223-R-1) Avail: CFSTI CSCL 05A

The purpose of this study was partly to update methods of modern project management, and partly to study NASA from a more objective, broader point of view and with greater articulation with the focus on the role of the project manager in the Apollo Program. It was found that the study of the project manager, the person, is inextricably entangled in the study of project management as an organization. Author

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University of Washington, Seattle

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Boston Public Library

MICHIGAN
Detroit Public Library

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